FISHERY MANAGEMENT INVESTIGATIONS

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Steven M. Huffaker, Director

REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS
UPPER SNAKE REGION (Subprojects I-G, II-G, III-G, IV-G

PROJECT I.	**SURVEYS and INVENTORIES**
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Job b^1.	**Upper Snake Region Lowland Lakes Investigations-Henrys Lake**
Job b^2.	**Upper Snake Region Lowland Lakes Investigations- Island Park Reservoir, Palisades Reservoir, Ririe Reservoir, Mud Lake, Roberts Gravel Pond**
Job c^1.	**Upper Snake Region Rivers and Streams Investigations- South Fork Snake River**
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PROJECT II.	**TECHNICAL GUIDANCE**
PROJECT III.	**HABITAT MANAGEMENT**
PROJECT IV.	**POPULATION MANAGEMENT**

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1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management

Project I: Surveys and Inventories

Subproject I-G: Upper Snake Region

Job: a

Title: Mountain Lakes Investigations

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

No mountain lakes were surveyed by Idaho Department of Fish and Game personnel in 1995.

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1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management

Project I: Surveys and Inventories

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Job: b[1]

Title: Lowland Lakes Investigations - Henrys Lake

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

From March 1 through May 8, 1995, 11,356 cutthroat trout *Oncorhynchus clarki* (55% male) were counted and marked in the Hatchery Creek spawning run at Henrys Lake. A total of 9,650 cutthroat trout received right pelvic fin clips, and 1,706 cutthroat trout received left pelvic fin clips and jaw tags. Male cutthroat trout averaged 475 mm, and females averaged 467 mm. A total of 2,603,551 cutthroat trout eggs were collected during the spawning run.

A total of 3,164 hybrid trout (rainbow X cutthroat *O. mykiss;* 56% male) were counted and marked in the Hatchery Creek spawning run. A total of 2,576 hybrid trout received right pelvic fin clips, and 588 hybrid trout received left pelvic fin clips and jaw tags. Male hybrid trout averaged 582 mm, and females averaged 567 mm total length. A total of 2,649,661 cutthroat trout eggs were collected for hybrid trout production during the spawning run for a total egg take of 5,253,212.

From October 2 through November 3, 1995, the fish ladder was operated on Hatchery Creek for the purpose of collecting brook trout *Salvelinus fontinalis* for spawning. A trap net was deployed October 24 through October 31, 1995. A total of 505 brook trout (54% male) were collected. Male brook trout averaged 389 mm and females averaged 418 mm total length. A total of 539,735 green eggs were collected from 223 females.

The 1995 population estimate of cutthroat trout larger than 350 mm in Henrys Lake was 295,281. The population estimate for hybrid trout larger than 350 mm was 316,046. Angling exploitation rates were estimated at 2.95% for cutthroat trout and 8.24% for rainbow X cutthroat hybrid trout in 1995.

Mean total length of cutthroat trout in the creel was 434 mm with a range of 225 mm to 685 mm. The percentage of cutthroat trout greater than 508 mm in total length was 8.7%. Mean total length of hybrid trout in the creel was 442 mm with a range of 241 mm to 762 mm. The percentage of hybrid trout greater than 508 mm in total length was 20.6%. Mean total length of brook trout in the creel was 431 mm with a range of 305 mm to 590 mm. Of brook trout examined in the creel, 27.2% were greater than 457 mm in length.

Angling pressure was estimated to be 172,646 hours in 1995. Idaho residents accounted for 65% of anglers on Henrys Lake. Total anglers were comprised of 52.6% boat anglers, 25.1% float tubers, and 22.3% bank anglers. Bait fishing accounted for 38% of fishing methods, lure fishing 25%, and fly fishing 37%.

The estimated catch was 99,286 fish. The overall season catch rate was 0.58 fish/h with an estimated season harvest of 20,627 fish. Of fish caught, 79% were released.

Gillnetting effort consisted of one net night per location at six locations. A total of 31 cutthroat trout, 25 hybrid trout and one brook trout were captured. No Utah chub *Gila atraria* were captured. Due to equipment problems, no purse seining was conducted on Henrys Lake in 1995.

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INTRODUCTION AND STUDY AREA

Henrys Lake is located in southern Idaho's northeast corner at the headwaters of the Henrys Fork of the Snake River. This 2,632 ha shallow eutrophic lake was designated a trophy trout fishery in 1976 when the Henrys Lake management program was implemented. The lake currently supports a native population of cutthroat trout *Oncorhynchus clarki*, with introduced rainbow x cutthroat *O. mykiss* hybrids, brook trout *Salvelinus fontinalis*, and non-native Utah chub *Gila atraria* which were discovered in 1993.

In 1982, the Henrys Lake Enhancement Plan was developed to offset declines in natural recruitment to the fishery due to degraded spawning habitat, fish passage barriers and loss of naturally produced fry to irrigation diversions from tributaries. In 1985 specific goals of the Enhancement Plan and management program were refined in the 1986-1990 Fisheries Management Plan, based on evaluation of fisheries data. In 1990, management goals for Henrys Lake were further refined in the 1991-1995 Fisheries Management Plan to provide for an overall catch rate of 0.7 fish/h with a catch rate of 0.45 fish/h for cutthroat trout, 0.15 fish/h for rainbow x cutthroat hybrid trout, and 0.1 fish/h for brook trout. Size goals in the creel are 20% of hybrid trout over 20 inches, 10% of cutthroat trout over 20 inches and 5% of brook trout 17 inches and over.

This report summarizes fishery investigations and spawning activities conducted at Henrys Lake during 1995 to evaluate and support various programs and management goals implemented by the Idaho Department of Fish and Game (IDFG).

OBJECTIVES

1. Describe the impact of standardized fish stocking levels of cutthroat trout, hybrid trout, and brook trout on angler success and harvest on Henrys Lake.

2. Describe the population characteristics of cutthroat, hybrid, and brook trout in Henrys Lake.

3. Estimate the rate of angling exploitation on the Henrys Lake trout population.

4. Recommend a course of action for the next five-year fisheries management plan for Henrys Lake.

METHODS

Spawning Operations

From March 1 through April 25, 1995, cutthroat trout were spawned to produce rainbow X cutthroat hybrid trout eggs and cutthroat trout eggs. Rainbow trout gametes were collected from Kamloops strain broodstock at the Ennis National Fish Hatchery in Ennis MT to produce hybrid trout. Henrys Lake cutthroat trout males and females were used to produce cutthroat trout to supply egg requests from various IDFG hatcheries and for return to Henrys Lake and its tributaries.

From March 1, through May 8, 1995, Henrys Lake cutthroat and hybrid trout ascended the fish ladder for counting, marking, and sorting. Each fish was anesthetized with MS 222 and checked for marks. A subsample of 10% of the fish was measured to the nearest 5 mm total length. Each fish was administered a right pelvic fin clip using 8-inch, bypass type, pruning shears. Fifty to 75% of the right pelvic fin was removed to produce a readily recognizable mark for easy identification in the spawning run and for subsequent identification in trapnetting and in the creel survey.

After spawning and marking, fish were returned to Henrys Lake via 6-inch pipe. Surplus broodstock were relocated to Howard Creek, a tributary of Henrys Lake. The egg taking operation was terminated when egg requests were filled.

The fish ladder was installed on October 2 and left in operation until November 3 to supplement the capture of brook trout in the fish ladder. A trap net was installed off Hatchery Creek on October 24 and removed on October 31 due to icing. Brook trout were removed daily from the trap net and transported to the spawning facility. Fish entering the spawning facility from the fish ladder were sorted, measured and spawned as stated above with the exception of not being fin-clipped. There were no surplus brook trout broodstock to relocate to Henrys Lake tributaries in 1995.

Population Sampling

We utilized trout marked with the right pelvic fin clip and additional trout tagged with reward jaw tags for estimates of total numbers of trout over 350 mm and the rate of angling exploitation.

In addition to trout receiving the right pelvic fin clip during spawning operations, cutthroat and hybrid trout receiving a jaw tag were also collected in the spawning facility from the fish ladder prior to the angling season. Fish were fin-clipped and jaw-tagged from April 25 through May 8, 1995. Fish were anesthetized, measured and checked for previous identifying marks. Scale samples were taken from selected trout.

Reward jaw tags were placed on the right lower mandible, and secured by using medium-sized needle-nosed pliers. Tagged fish were also given a left pelvic fin clip to assess tag retention. Fifty to 75% of the left pelvic fin was removed in the same manner described above for the right pelvic fin clip. As in 1994, posters describing tag location, type of tag and return instructions were placed at each access site and fish cleaning station prior to the fishing season. We encouraged anglers to harvest and claim the reward only if they would have kept the fish under normal circumstances. We also increased the reward for tag returns to $10.00 (from $5.00 in 1994) to enhance the incentive to comply with requests for tag returns. We used the percentage of reward tag returns to estimate the rate of exploitation of Henrys Lake trout recruited to the fishery.

Tagged trout were recovered in the spawning facility and held for 24 to 48 hours to monitor for mortality and to check tag retention. Tagged trout were then released through the return pipe back to the lake.

Harvested fish were examined during the standardized creel survey from May 27 to October 31, measured to the nearest mm, checked for identifying marks, and species recorded. Sex of fish was not recorded due to the difficulty of determination during the summer season. During the opening weekend of the fishing season, teams of two Department personnel were stationed at each of five access sites to observe fish, interview anglers, explain the study, and recover jaw tags. Teams were in place approximately hours each on the first two days of the season.

We estimated the total number of Henrys Lake trout greater than 350 mm using fish marked with the right pelvic fin clip in the hatchery run. Creeled trout were examined during angler interviews in the season-long creel survey. A modified Peterson-type formula was used as follows:

$$N = \frac{(M+1)\,(C+1)}{(R+1)}$$

where: M = the number of fish marked
C = the catch or sample taken for census
R = the number of recaptured marks in the sample
N = the size of the population at the time of marking

An additional population estimate was made from the estimate of harvested fish divided by the estimated exploitation rate.

Separate estimates were made for cutthroat and hybrid trout. We were not able to mark enough brook trout to generate an estimate of their numbers in 1995.

Gillnetting

Experimental gill nets were set at standardized locations on June 12 and 13 for a total of six net nights. Nets were deployed at dusk and worked at dawn the following morning. Total fish length was recorded to the nearest millimeter, species recorded and scale and otolith samples taken for age and growth analysis.

Creel Survey

A standardized roving angler survey was conducted from May 27 to October 31, 1995 to assess fishing pressure, catch rates, and harvest rates for trout species in Henrys Lake. Angler counts were made from watercraft three times each angler count day.

During inclement weather, counts were made from a vehicle along a prescribed route. Counts were cancelled or rescheduled on limited visibility days (fog or mist) and on days that lightning threatened safety. Angler counts and interviews were randomly scheduled on 50% of weekend days, 20% of weekdays and on all holidays.

The survey period was divided into seven intervals of 28 days duration except the first and last intervals. Interval one duration was three days to stratify the increased effort (approximately 20%) that occurred on the three-day opening weekend. Interval seven was a two-week interval because the fishing season ended on October 31.

Limnological Sampling

Dissolved oxygen (DO) sampling was conducted 1,600 m south of the mouth of Pittsburgh Creek, 300 m south of the mouth of Wild Rose Creek and 100 m south of the mouth of Hatchery Creek within the area effected by the helixing system. Monitoring was done in order to develop a depletion model for 1995. Sampling was conducted on January 15, January 24, and March 7. Dissolved oxygen was measured using a YSI model 57 oxygen meter. A gasoline-powered ice auger was used to open a 25.4 cm hole in the ice, and slush was removed using an ice fishing skimmer. The initial oxygen reading was taken at the bottom of the ice layer. The next reading was at 1 m and then at 1 m intervals to the bottom. The final reading was taken just up off the bottom (approximately 15 cm), and the depth was recorded.

The readings in mg/l were averaged for the ice and 1 m depths, and subsequent 1 m and bottom readings were added to give the grams of free oxygen beneath that square meter point on the lake. Subsequent readings were accumulated, and a depletion rate was obtained by dividing the difference in oxygen by the number of days between samples to yield a depletion rate in g/m^2/day. This depletion rate in turn was used to estimate the number of days remaining until a critical total oxygen level of 3.3 g/m^2 of surface area remained. If the number of days was well short of the traditional mid-May ice-off, then aeration devices were deployed at established sites around Henrys Lake.

RESULTS AND DISCUSSION

Spawning Operations

The 1995 run consisted of 11,356 cutthroat and 3,164 hybrid trout, totaling 14,520 fish (Figure 1). Cutthroat trout males numbered 5,026 and cutthroat trout females numbered 6,330. Hybrid males numbered 1,779, and 1,385 females were counted. Average length for male cutthroat trout was 475 mm (n=647), and females averaged 467 mm total length (n=647; Figures 2 and 3). Combined average cutthroat trout total length was 471.53 mm. Hybrid trout males averaged 582 mm (n=426), and females averaged 567 mm (n=414; Figures 4 and 5). Combined average length for male and female hybrid trout was 575 mm.

Cutthroat trout green eggs totaled 2,603,551 from 1,160 females for an average fecundity of 2,224 eggs per female. Green egg yield was 1,868,765 eyed eggs for an eye-up survival of 71%.

Hybrid trout green eggs totaled 2,649,661 from 1,186 female cutthroat trout for an average fecundity of 2,234 eggs per female. Eyed hybrid trout eggs totaled 1,868,765 for an eye-up survival of 71%.

Brook trout were spawned during the fall of 1995. Henrys Lake was at full capacity during early October. Morpholine was used to imprint brook trout fry planted in previous years, and a drip system was initiated into the spawning facility on September 20. Brook trout did not ascend the fish ladder in adequate numbers; therefore it was necessary to use the trap net to collect brook trout massed off the mouth of Hatchery Creek.

A total of 505 brook trout were accumulated from the fish ladder and trap net. Male brook trout totaled 273, and females totaled 232. Temiscamie and naturalized brook trout were spawned randomly as in previous years.

Brook trout green eggs totaled 558,175 from 223 females for an average fecundity of 2,503 eggs per female. Eyed eggs totaled 445,659 for an eye-up survival of 80%.

Male brook trout averaged 389 mm total length (n=114) (Figure 6), and female brook trout averaged 418 mm total length (n=171; Figure 7).

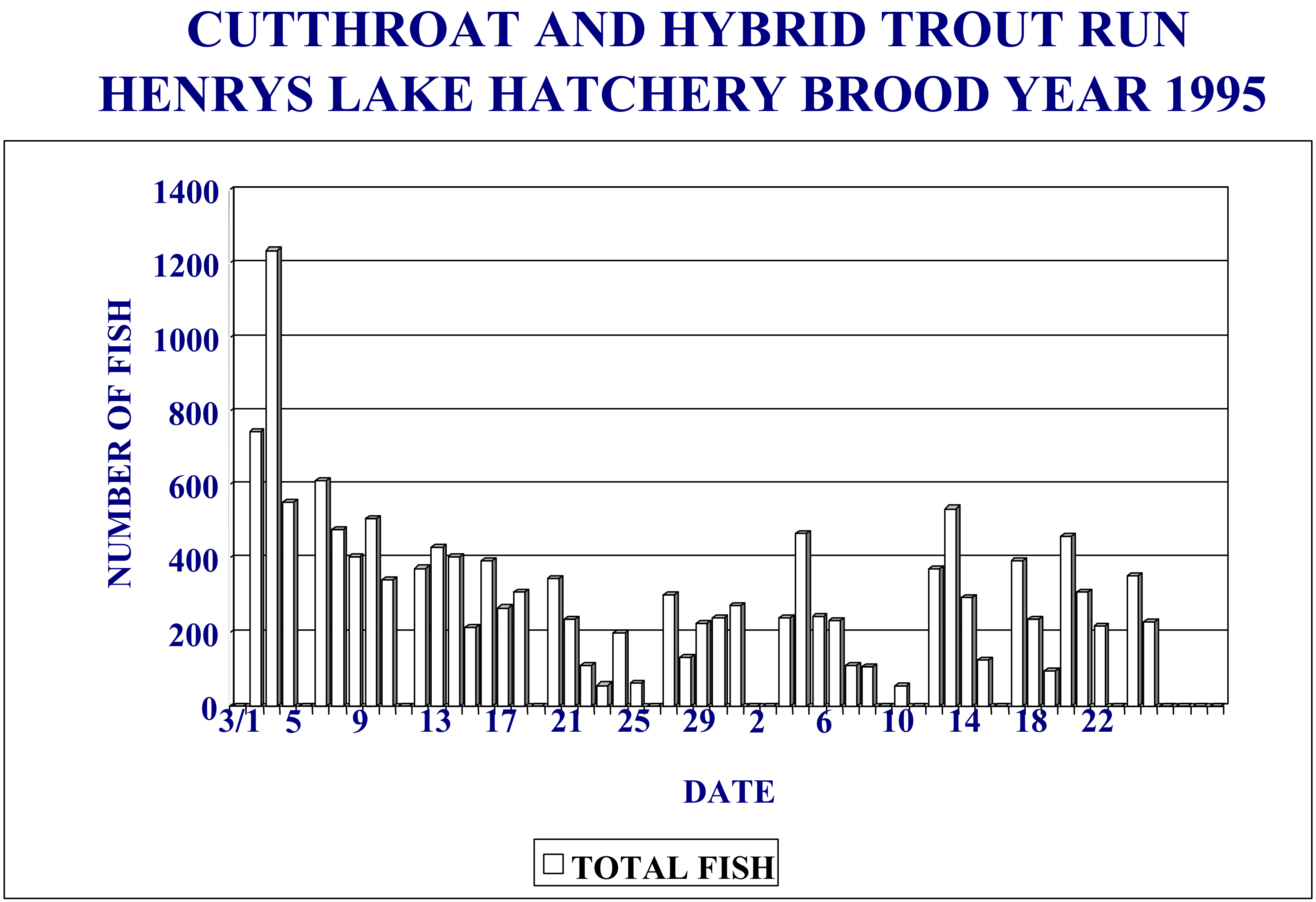

Figure 1. Cutthroat & hybrid trout run timing, n=14,520.

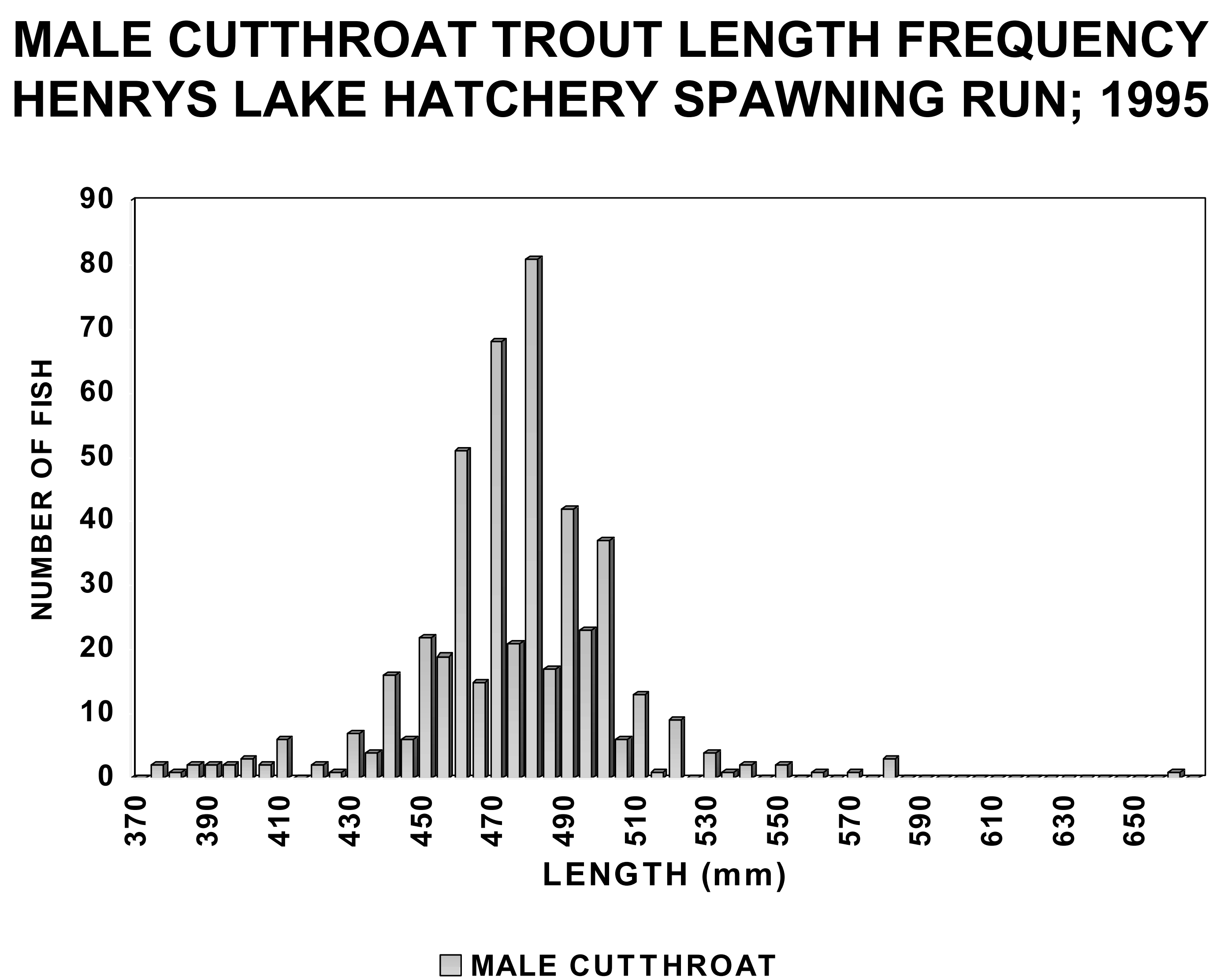

Figure 2. Male cutthroat trout length frequency from hatchery run, n=647.

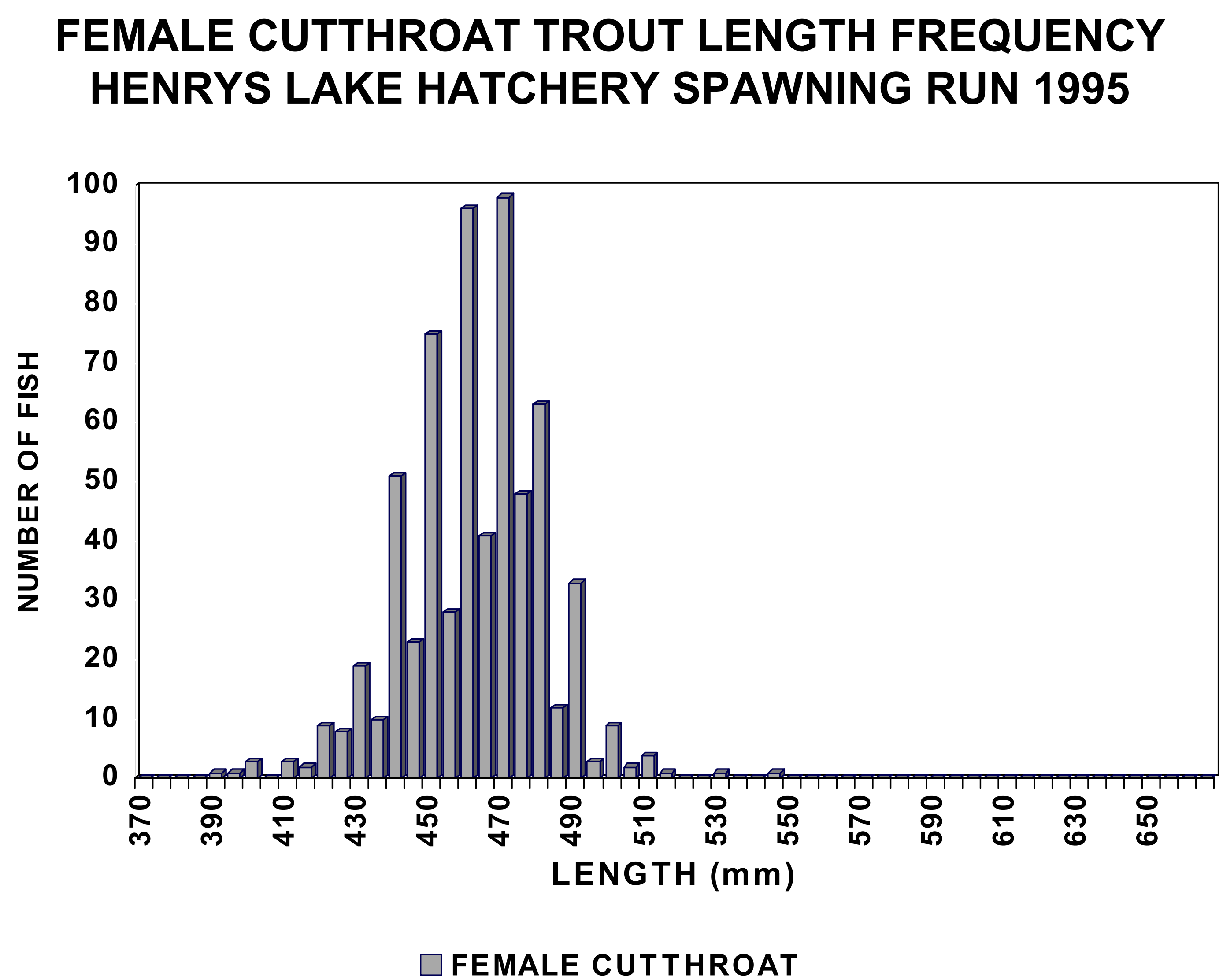

Figure 3. Female cutthroat trout length frequency from hatchery run, n=647.

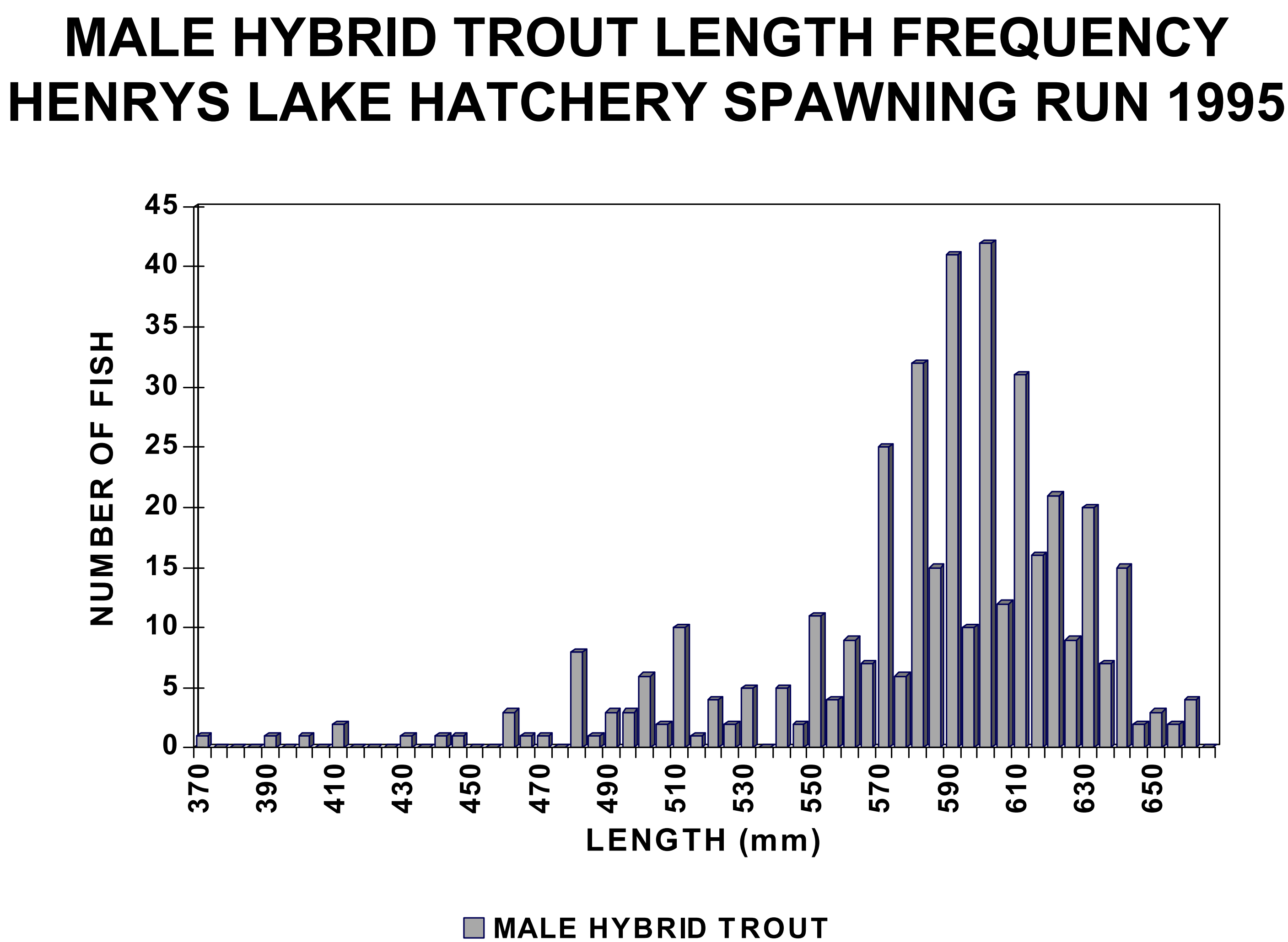

Figure 4. Male hybrid trout length frequency from hatchery run, n=426.

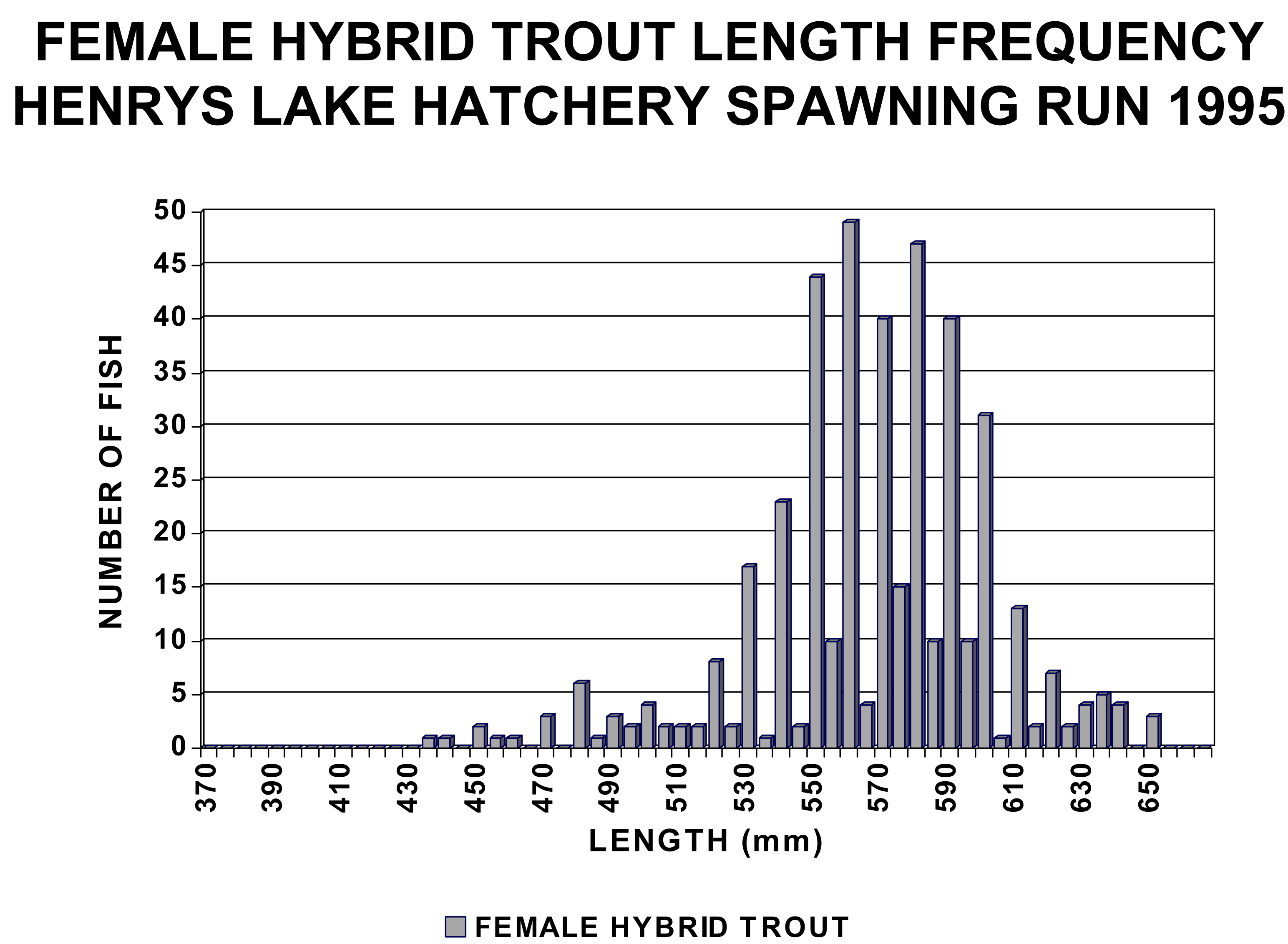

Figure 5. Female hybrid trout length frequency from hatchery run, n=414.

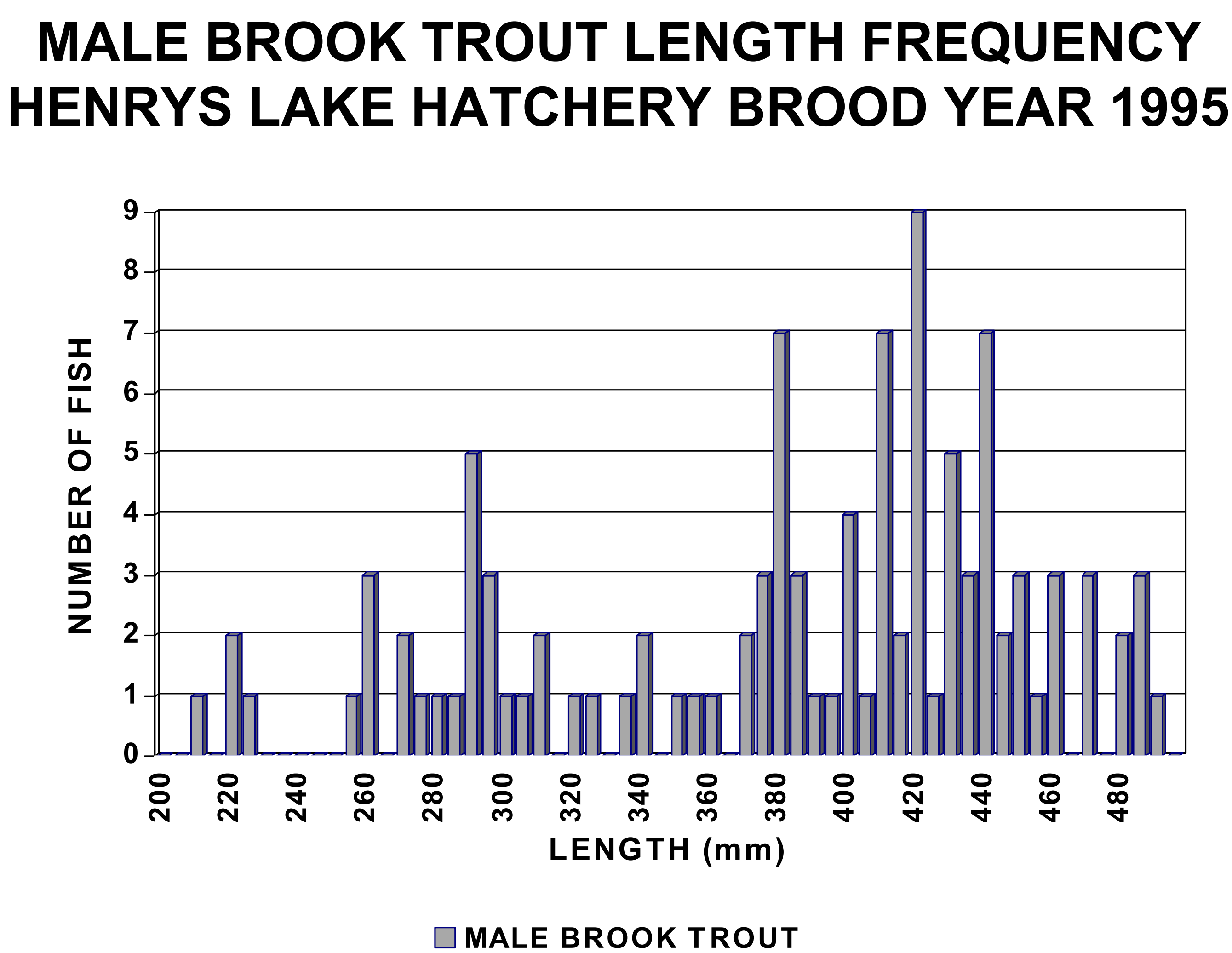

Figure 6. Male brook trout length frequency from hatchery run, n=114.

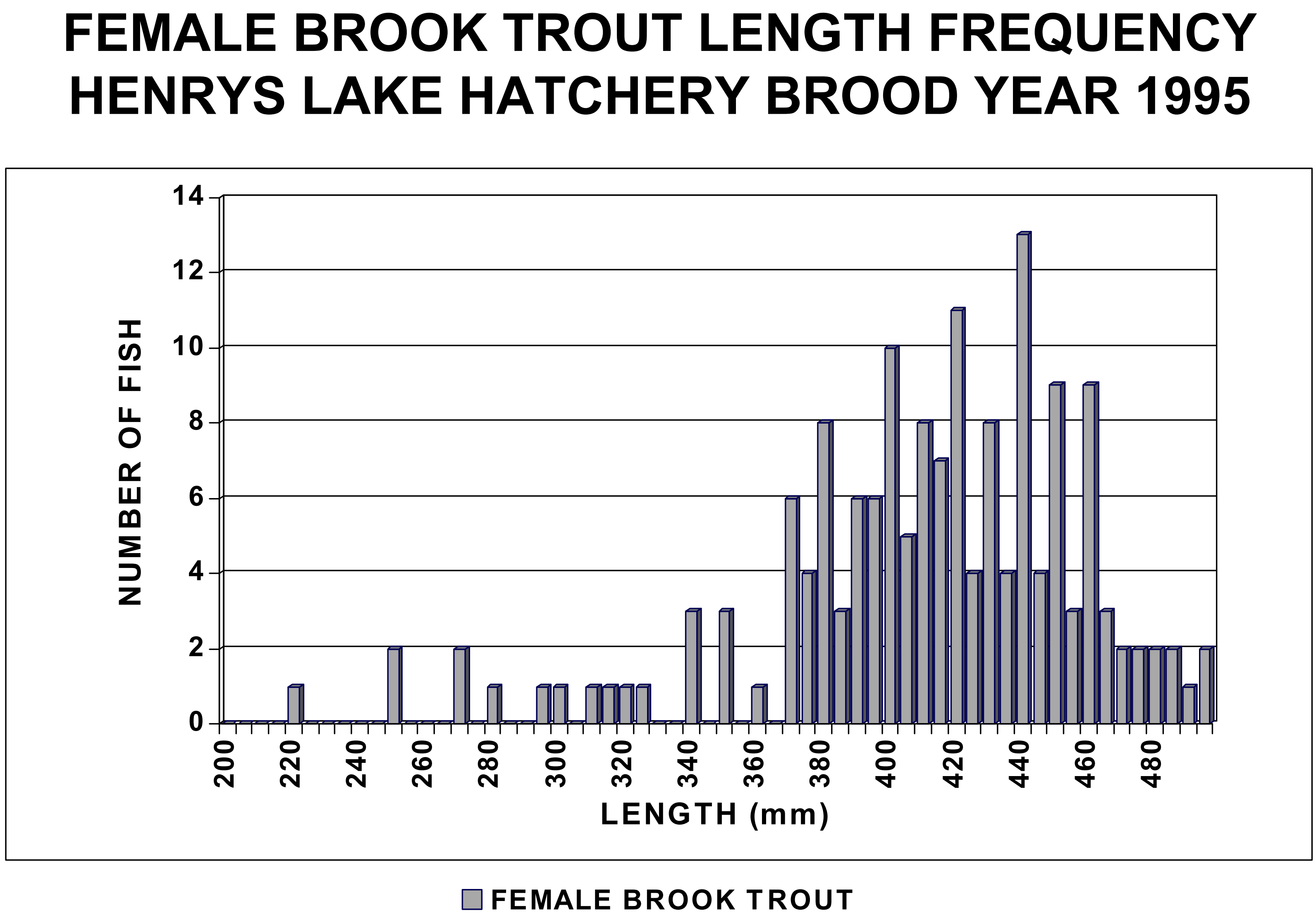

Figure 7. Female brook trout length frequency from hatchery run, n=171.

Population Sampling

A total of 1,358 cutthroat and 681 hybrid trout were jaw-tagged in the spawning facility between April 25 and May 8, 1995. Tagged fish were predominately over 350 mm in total length. Right ventral fin clips were given to 11,356 cutthroat trout and 3,164 hybrid trout in the hatchery run. A total of 415 cutthroat trout and 698 hybrid trout were examined for marks/tags in the creel during 1995. Henrys Lake anglers turned in a total of 48 reward tags to Department personnel during 1995. Of the total, 20 tags were from cutthroat trout and 28 tags were from hybrid trout. Assuming that 50% of the reward-tagged trout died before the fishing season, we calculated 1995 exploitation rates of 2.95% for cutthroat trout and 8.24% for hybrid trout in the Henrys Lake fishery. Also assuming that 50% of trout receiving a right pelvic fin clip died before becoming vulnerable to harvest during the 1995 fishing season, we calculated total numbers of cutthroat and hybrid trout over 350 mm at 147,654 and 158,074, respectively (Tables 1 and 2).

Gillnetting

Cutthroat trout totaled 31 fish ranging in length from 225 mm to 442 mm with an average length of 329 mm (Figure 8). Hybrid trout totaled 25 fish ranging in length from 310 mm to 515 mm with an average length of 386 mm (Figure 9). Three brook trout were sampled by gill net with lengths of 364, 218 and 291 mm. No Utah chubs were sampled by gillnetting. Cutthroat trout comprised 53.45% of the 59 fish netted; hybrid trout, and brook trout accounted for 43.1% and 3.45% respectively (Figure 10).

Creel Survey

The 1995 angler survey consisted of 50 survey days over the five-month fishing season on Henrys Lake. There were 3,570 anglers interviewed in 2,376 interviews; 65% were residents and 35% were nonresidents (Figure 11). There were 1,081 completed trips documented with an average trip length of 3.4 hours. Instantaneous counts indicated 52.64% of anglers fished from boats, 22.26% fished from shore and 25.1% of anglers fished with float tubes (Figure 12). Bait fishing accounted for 38% of fishing methods, while lure fishing was 25% and fly fishing comprised 37% (Figure 13). Catch composition consisted of 36.52% cutthroat trout, 60.10% hybrid trout and 3.38% brook trout (Figure 14).

Angling effort totaled 172,646 hours, and the interval estimate was 145,413 to 199,879 at the 95% confidence level. Total catch was 99,286 fish and the interval estimate was 84,667 to 113,905 at the 95% confidence level. The overall season catch rate was 0.58 fish/h. The season harvest total was 20,627 fish for a harvest catch rate of 0.12 fish/h. The proportion of fish released was 79% (Table 3).

Cutthroat trout sampled in the creel had an average total length of 434 mm with a range of 225 mm to 685 mm (n=415; Figure 15). Hybrid trout average total length was 442 mm with a range of 241 mm to 762 mm (n=698; Figure 16). Brook trout average total length was 431.5 mm with a range of 305 mm to 590 mm (n=22; Figure 17).

Of 415 cutthroat trout observed in the creel survey, 10 had adipose fin clips. This equates to 2.409% of observed fish with adipose clips. Each year 10% of stocked fish are given adipose fin clips. Multiplying 2.409% by 10 gives 24.09% as the proportion of hatchery fish in the population. Conversely

Table 1. Estimate of 1995 cutthroat trout population prior to fishing season on Henrys Lake and method used to estimate abundance.

Type of sample	Population estimate at 95% confidence
RV clip over entire season	(78,827 ≤147,654 ≤216,481)
Harvest estimate	
Exploitation estimate	(143,260 ≤243,379 ≤343,498)

Table 2. Estimate of 1995 hybrid trout population prior to fishing season on Henrys Lake and method used to estimate abundance.

Type of sample	Population estimate at 95% confidence
RV clip over entire season	(49,084 ≤158,074 ≤267,064)
Harvest estimate	
Exploitation estimate	102,819 ≤156,329 ≤209,839

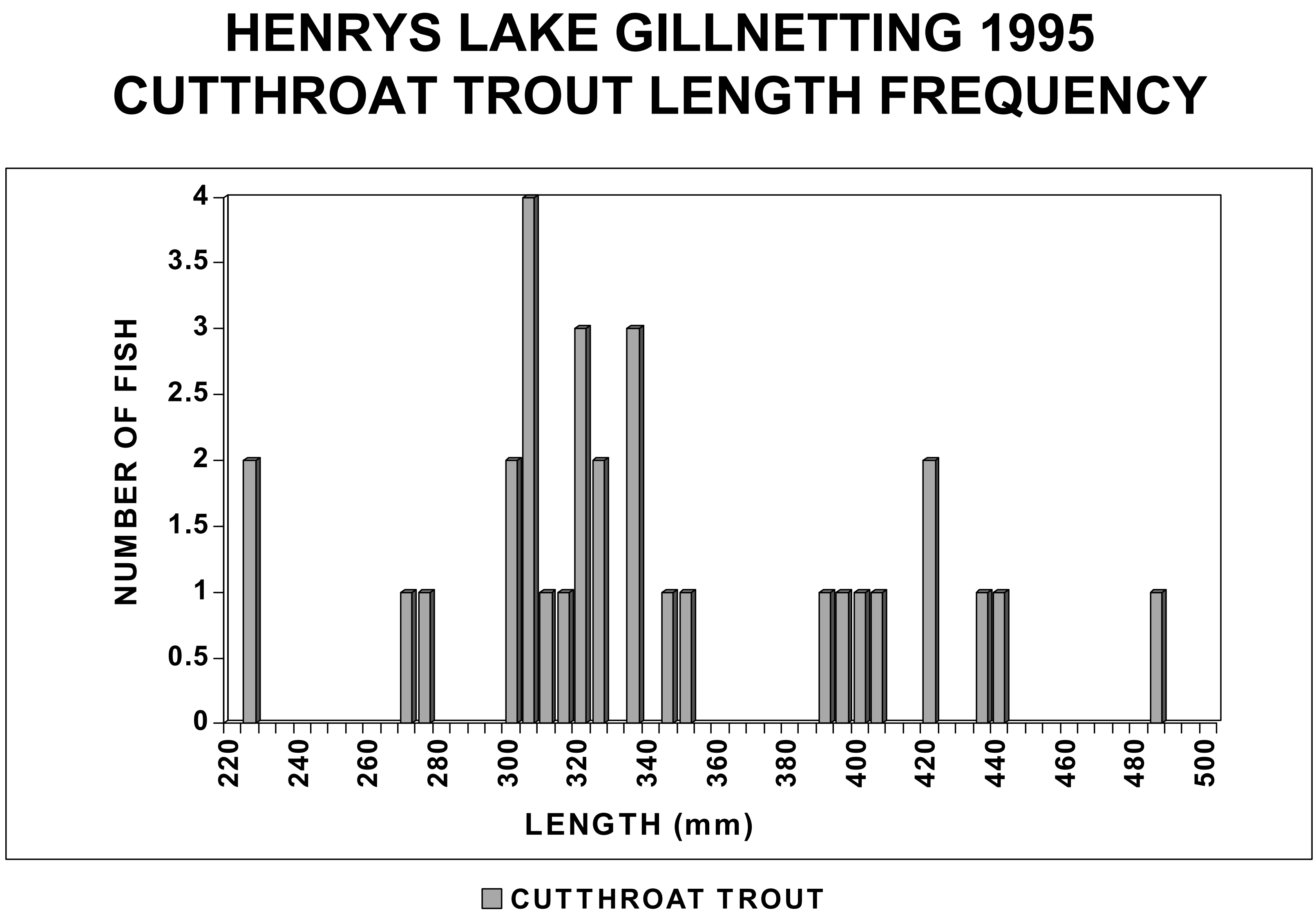

Figure 8. Length frequency of cutthroat trout from 1995 gillnetting, n=31.

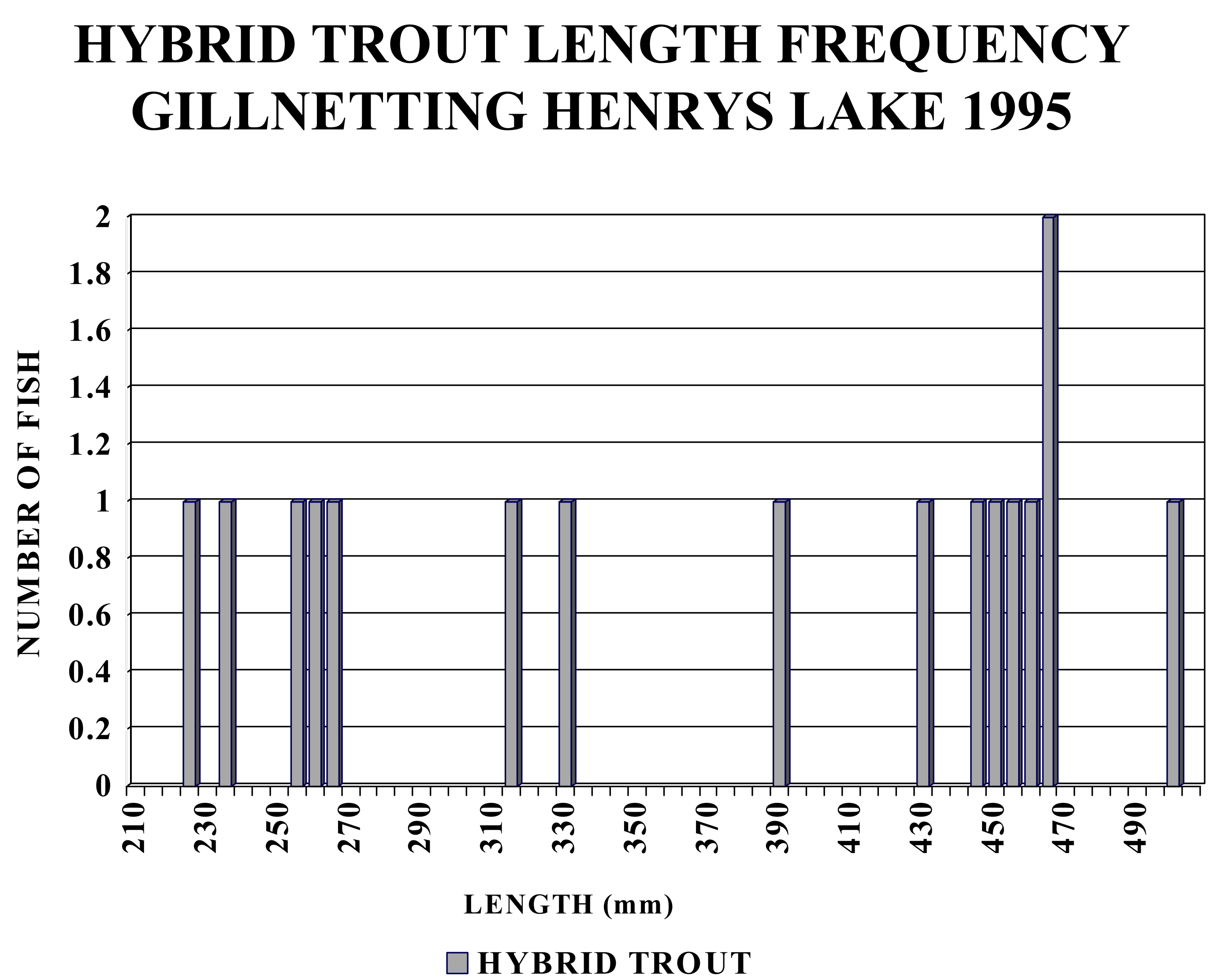

Figure 9. Length frequency of hybrid trout from 1995 gillnetting, n=25.

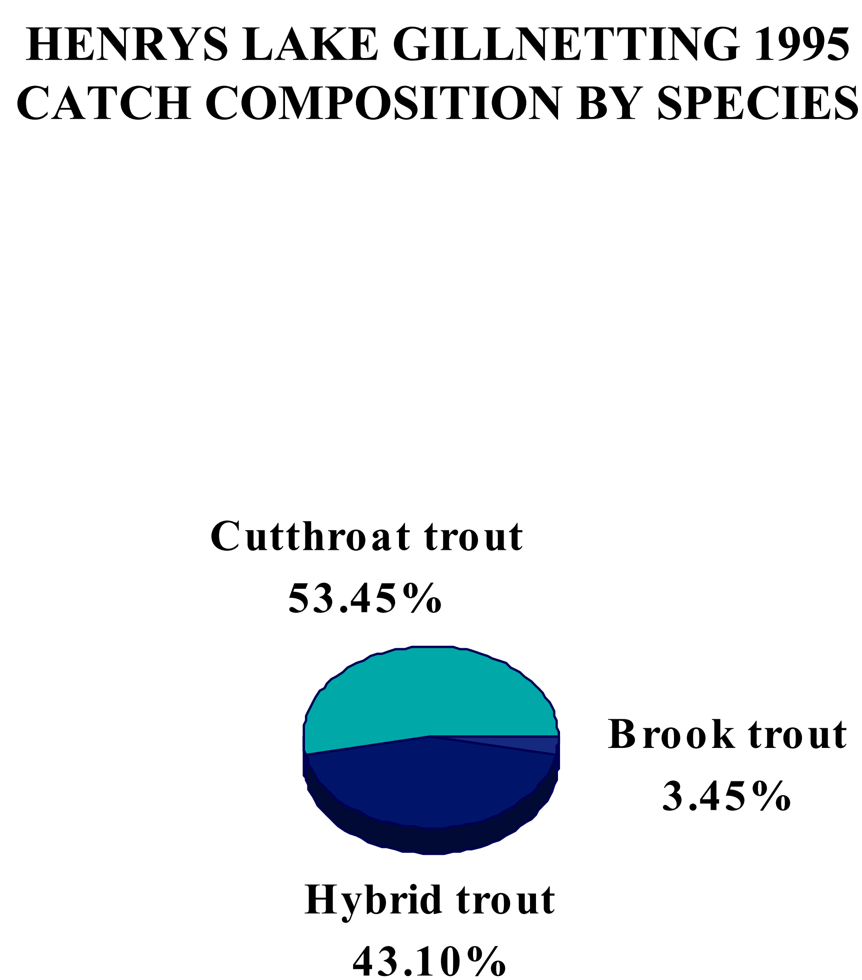

Figure 10. Percent catch composition from 1995 gillnetting, n=59.

ANGLER COMPOSITION
HENRYS LAKE CREEL SURVEY, 1995

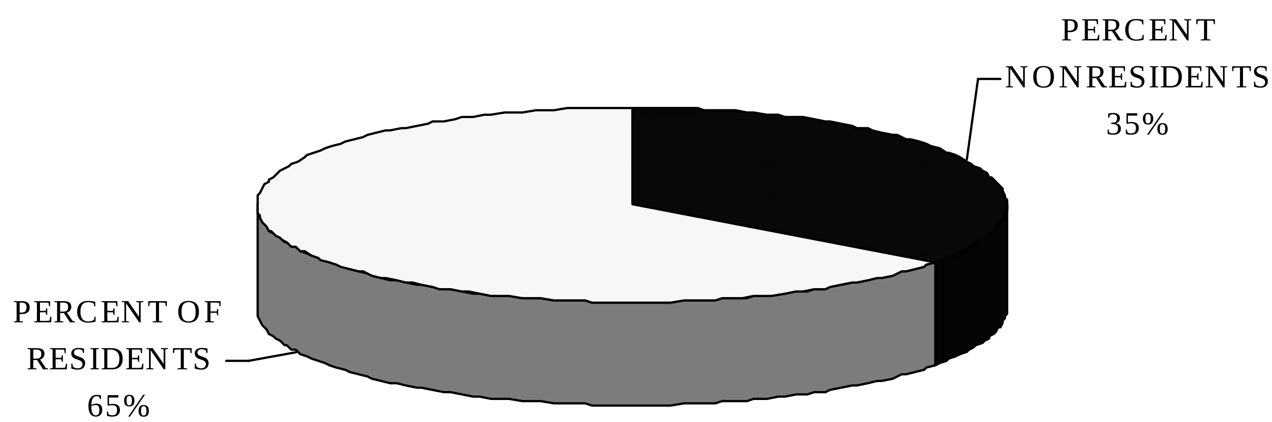

Figure 11. Angler composition from 1995 creel survey interviews, n=3,570.

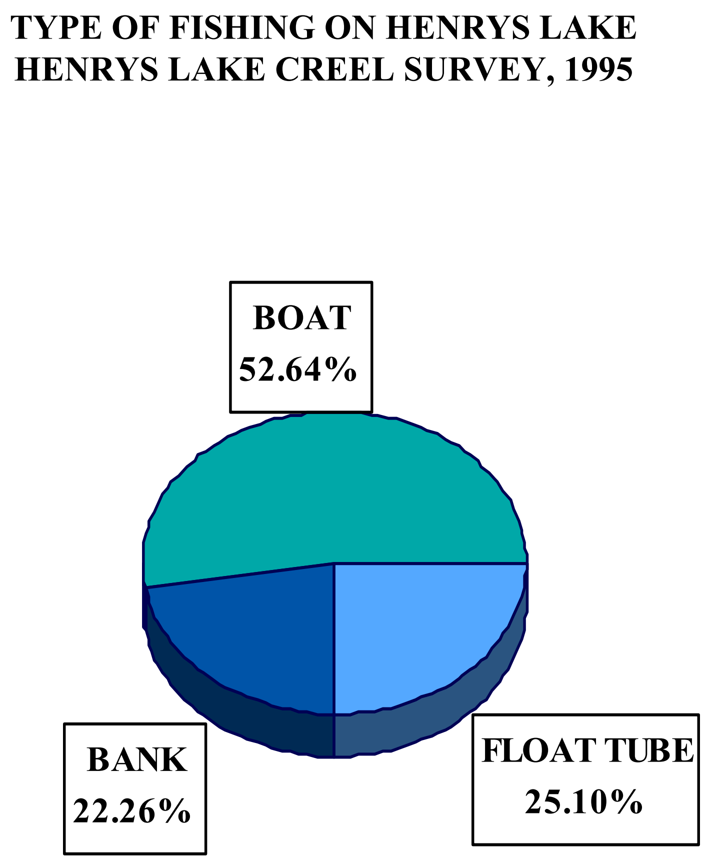

Figure 12. Type of fishing on Henrys Lake from 1995 creel survey.

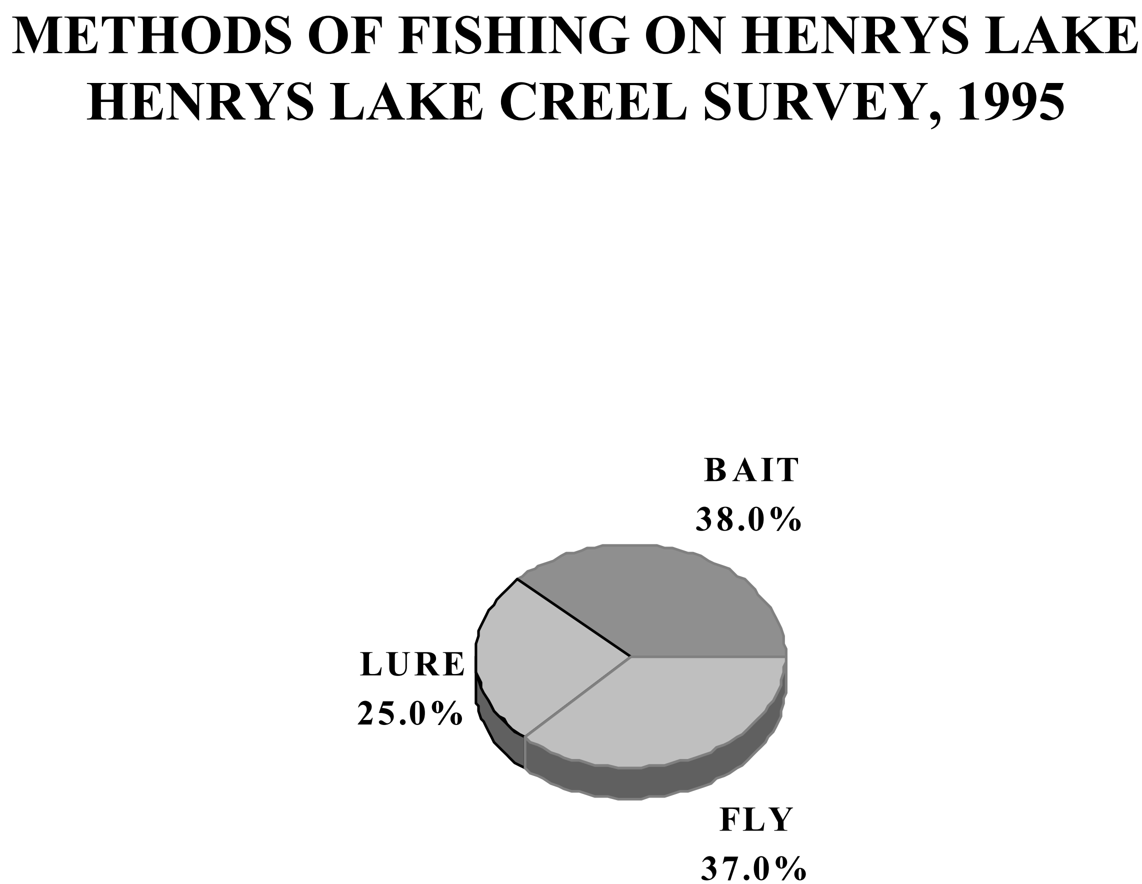

Figure 13. Fishing methods used by anglers on Henrys Lake in 1995.

CATCH COMPOSITION ON HENRYS LAKE
HENRYS LAKE CREEL SURVEY, 1995

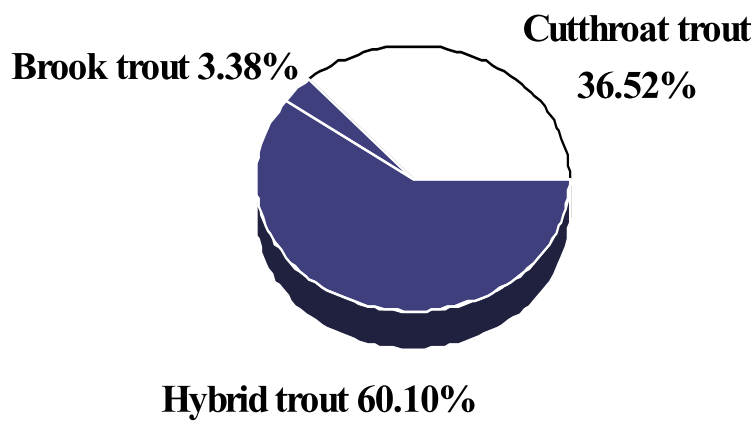

Figure 14. Catch composition from 1995 creel survey on Henrys Lake.

Table 3. Summary of Henrys Lake creel data from angler interviews, May to October, 1995.

Effort (total hours)	Harvest	Harvest rate	Catch rate	Percent released
172,646	20,627	0.12	0.58 f/h	79.0

	Catch composition (%)		
May - October	Cutthroat	Hybrid	Brook
	36.52	60.10	3.38

	Mean size (mm)	% >20”	No. >20”	Total harvest May - October
Cutthroat	434.33	8.7	36	7,058
Hybrid	442.38	20.6	144	12,819
Brook	431.50	% >18”	No. >18”	1,192
		27.2	785	
			Total	20,662[a]

	Effort	Released	Harvested	Total catch
Interval 1 (5/27 - 5/29)	19,400	5,723	2,095	7,818
Interval 2 (5/30 - 6/22)	43,356	15,331	5,082	20,413
Interval 3 (6/23 - 7/20)	39,078	19,814	5,343	25,157
Interval 4 (7/21 - 8/17)	28,909	14,384	2,713	17,077
Interval 5 (8/18 - 9/14)	15,548	7,999	2,553	10,560
Interval 6 (9/15 - 10/12)	21,524	13,534	2,519	16,053
Interval 7 (10/13 - 10/31)	4,831	1,886	322	2,208
Totals	172,646	78,671	20,627	99,286

[a] Difference is software rounding error.

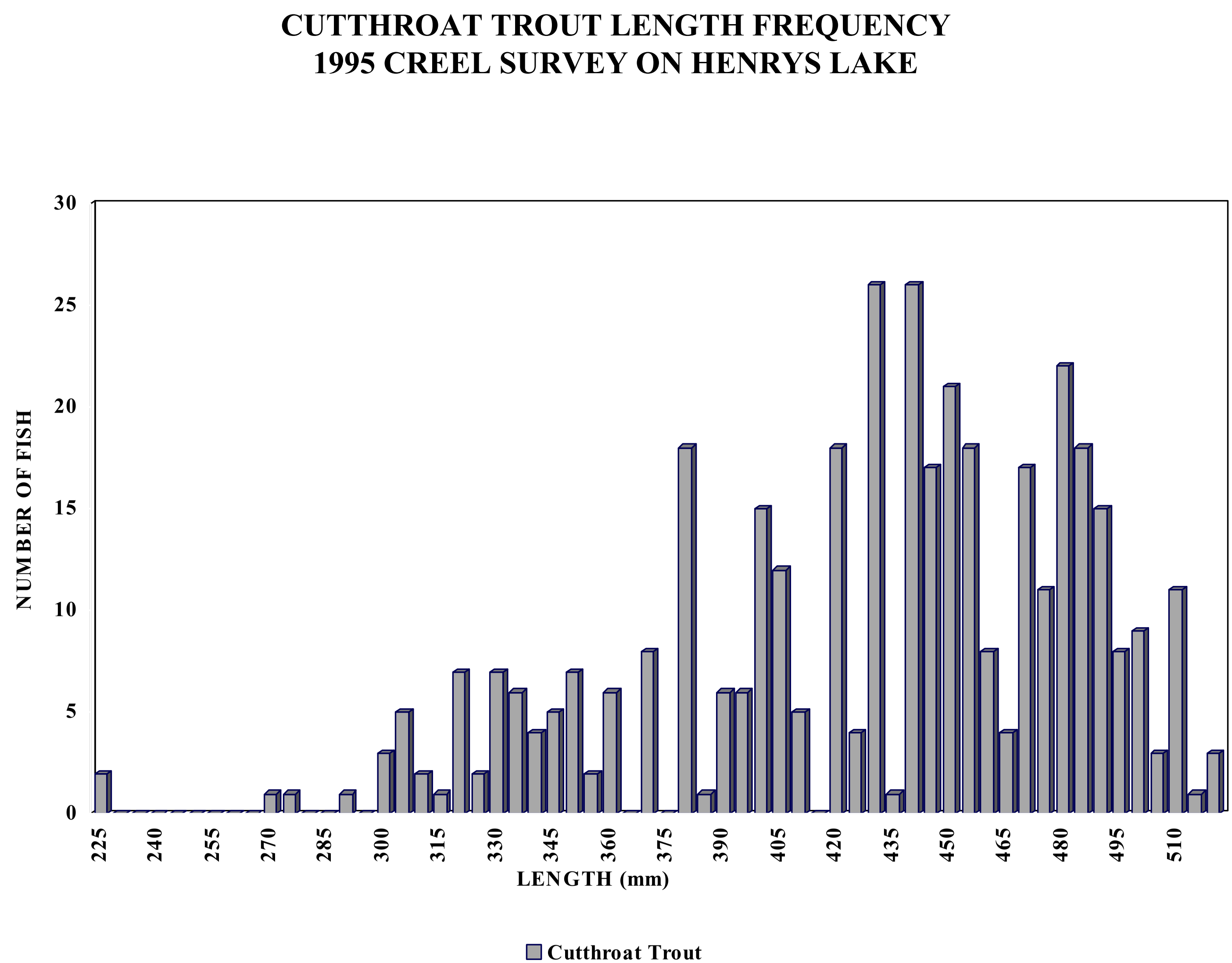

Figure 15. Cutthroat trout length frequency from 1995 creel survey, n=415.

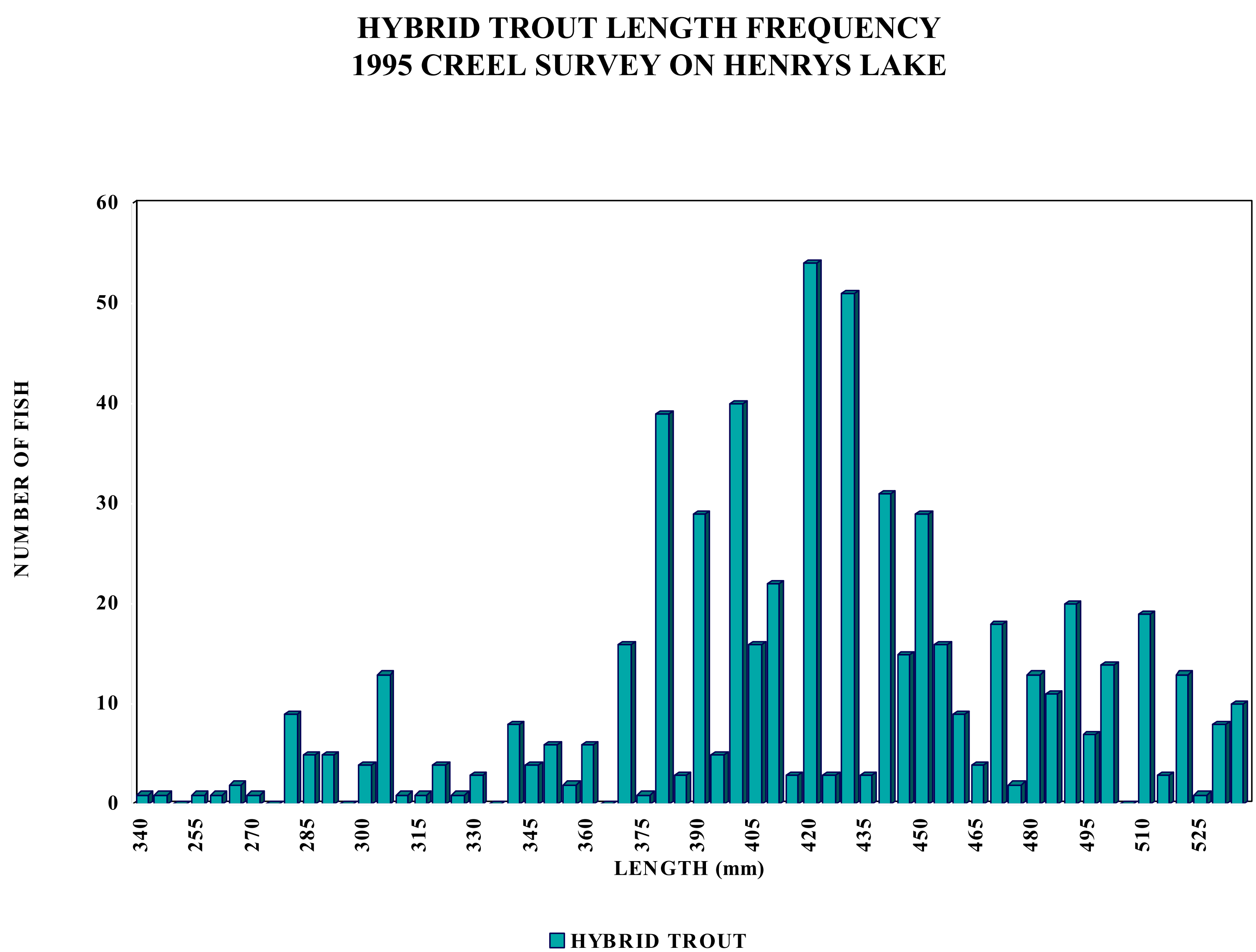

Figure 16. Hybrid trout length frequency from 1995 creel survey, n=698.

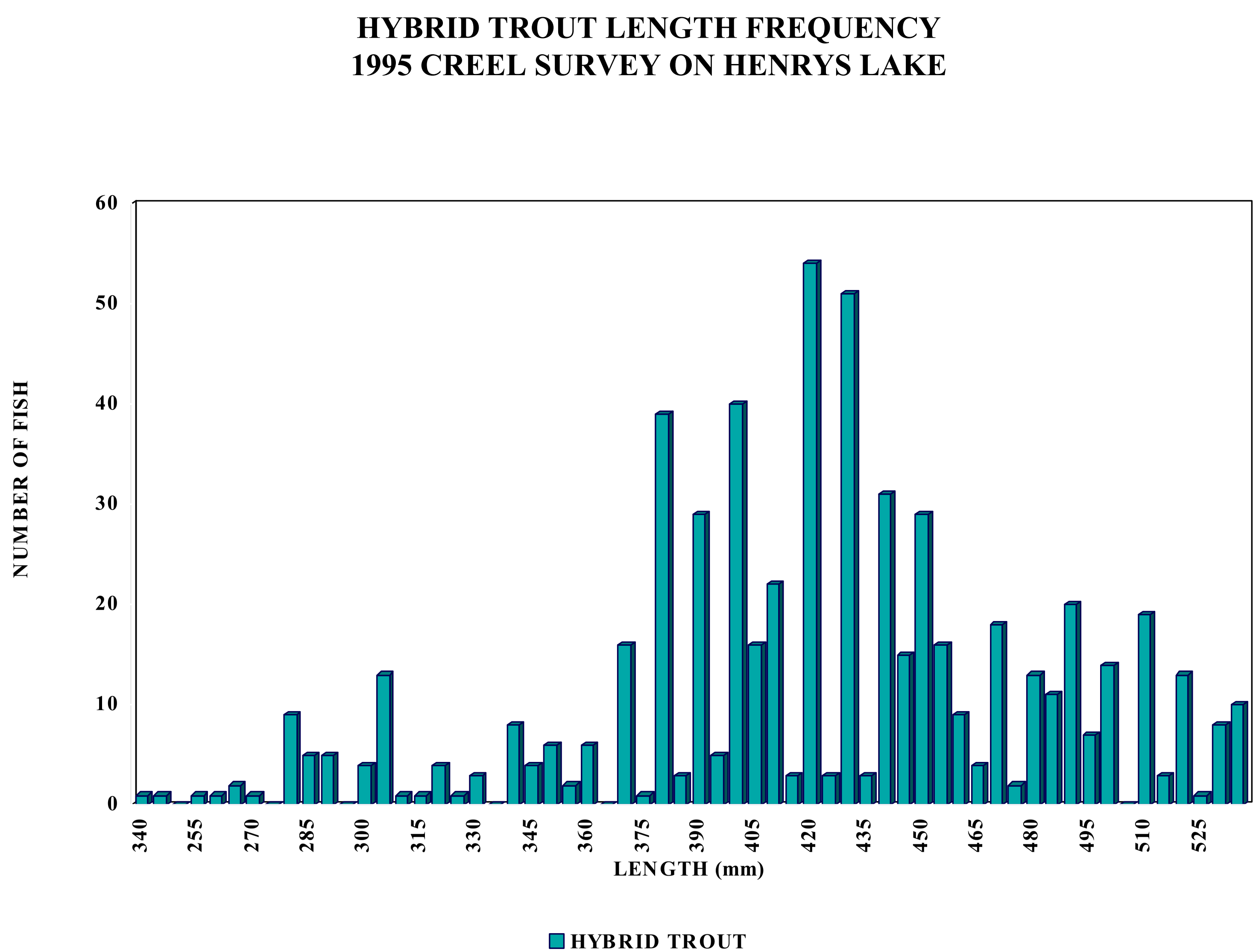

Figure 17. Length frequency of brook trout from 1995 creel survey, n=22.

75.91% of the population would be of wild origin. This is a 5% increase over the 1994 estimate of 70% wild fish in the population.

Limnological Sampling

Ice formation on Henrys Lake occurred on November 4, 1994. Snow accumulated greater than 7 cm on lake ice quickly after ice formation, limiting light transmission and resulting in subsequent super-saturation of oxygen. The accumulation of slush on the ice prevented consistent access to the county boat dock on the northwest shore of Henrys Lake and to the sample site 300 m south of Wild Rose Creek. By January 15 it was possible to sample 300 m south of Wild Rose, and oxygen totaled 9.6 g. On January 24 sampling was conducted 1,600 m south of Pittsburgh Creek. Conditions permitted sampling again on March 7 south of Pittsburgh Creek. On January 24 oxygen totaled 18 g south of Pittsburgh Creek and on March 7, 41 days later, total oxygen was at 7.7 g, for a depletion rate of 0.25 $g/m^2/d$ providing an estimated 17.6 days of acceptable oxygen (Figure 18).

Fisheries management personnel decided to deploy portable aeration equipment at Staley Spring, Wild Rose Resort and Pittsburgh Creek in addition to the helixing system based at the hatchery. Portable aeration equipment was used through the end of April, when the shoreline was ice free around the north and west shorelines of the lake and wind aeration was adequate to support fish with dissolved oxygen above 3.5 mg/l. No fish mortality was observed anywhere along the shore after ice left the lake in mid-May.

RECOMMENDATIONS

1. Reduce the frequency of Henrys Lake creel survey to every other year.

2. Evaluate the necessity of operating the Henrys Lake aeration system regardless of winter water quality conditions. Consider operating the aeration system only when dissolved oxygen monitoring indicates risk of winter kill.

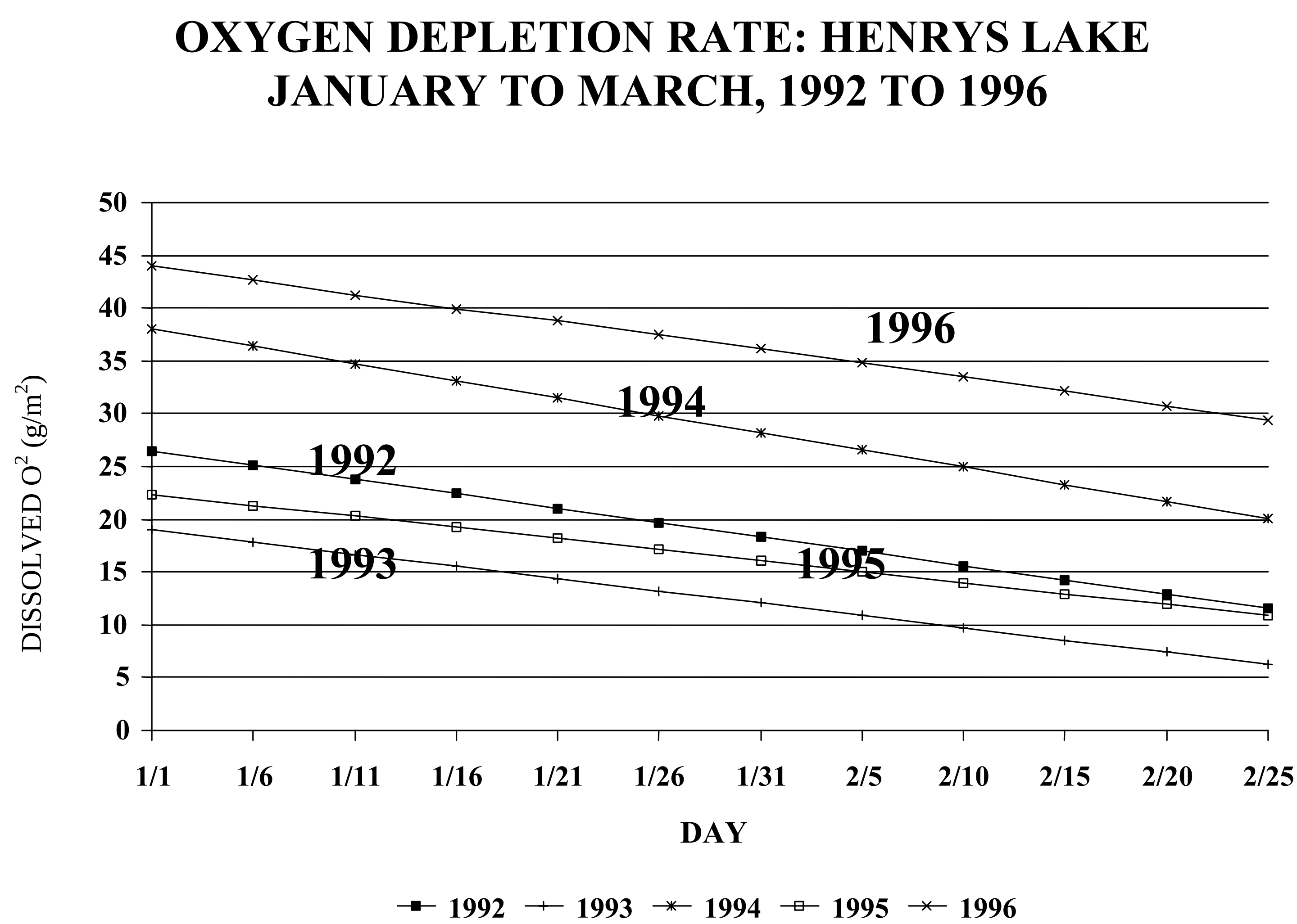

Figure 18. Oxygen depletion rate during winter of 1995 compared to prior years.

1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-20

Project I: Surveys and Inventories

Subproject I-G: Upper Snake Region

Job: b[2]

Title: Lowland Lakes Investigations - Island Park Reservoir, Market Lake, Mud Lake, Palisades Reservoir, Ririe Reservoir, Roberts Gravel Pond

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

Fishing success at Island Park Reservoir was modest with an average catch rate of 0.4 fish/hr. The kokanee salmon *Oncorhynchus nerka kennerlyi* spawning escapement was estimated at 1,500 fish in the Upper Henrys Fork. Spawn run males and females ranged in length from 450 to 535 mm and 430 to 495 mm, respectively. A lowland lake survey revealed increasing catch-per-unit-effort (CPUE) and proportion of nongame fishes in the survey sample.

Electrofishing effort at Market Lake Wildlife Management Area (WMA) captured representatives of multiple age classes of yellow perch *Perca flavescens* and many Utah chub *Gila atraria*.

Dissolved oxygen monitoring at Mud Lake in late winter showed a severe hypoxic condition in all areas of the lake except a small refuge area along the northeast shoreline. A subsequent lowland lake survey conducted in unfavorable high water conditions produced many young-of-year (YOY) and yearling yellow perch. We believe a partial winterkill of more sensitive species likely occurred.

The kokanee salmon spawning run at Big Elk Creek, a tributary of Palisades Reservoir, was not a public relations or enforcement problem as in 1994, when extremely low water levels exposed spawners to view as they swam upstream in the dewatered Big Elk Creek subimpoundment. Kokanee salmon trawling again failed to produce a kokanee salmon, but Mysis shrimp *Mysis relicta* were collected.

Bass tournaments at Ririe Reservoir had poor catch rates, but typical for the fishery since 1992. Kokanee salmon trawling captured only 28 fish with mean length of 140 mm.

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OBJECTIVES

1. Determine characteristics of the current fish community and fishery of Island Park Reservoir. This is a continued effort since the 1992 renovation to monitor the magnitude and duration of the benefits of that project.

2. Determine characteristics of the current fish community in the main canal of Market Lake Wildlife Management Area (WMA). The WMA provided a significant fishery prior to the drought of the late 1980s and early 1990s. This was an effort to see what fish remained.

3. Determine winter dissolved oxygen (DO) conditions and characteristics of the current fish community of Mud Lake. Poor overwinter dissolved oxygen conditions in 1995 led to concern about the fish community that was rebuilding from a near total winterkill in 1993.

4. Collect anecdotal information about gamefish populations in Palisades Reservoir for management purposes.

5. Collect anecdotal information about gamefish populations in Ririe Reservoir for management purposes.

6. Determine characteristics of the current fish community, limnology, and morphology of Roberts Gravel Pond for formulation of new management alternatives.

METHODS

Island Park Reservoir

Creel Survey (On-the-water)

A low intensity, on-the-water creel survey was conducted on Island Park Reservoir May through July 1995. Fishery management and enforcement personnel surveyed bank, boat, and float tube anglers. Our objective was to continue monitoring the recovery of the Island Park Reservoir fishery following the 1992 rotenone renovation project.

Kokanee Salmon Spawning Run

Fall 1995 kokanee salmon *Oncorhynchus nerka kennerlyi* spawning run observations were collected during creel survey efforts on the Upper Henrys Fork, and Ashton Hatchery personnel gathered data while operating the kokanee salmon trap at Moose Creek in August and September.

Lowland Lake Survey

A lowland lake survey was conducted on Island Park Reservoir June 26-27. Sampling consisted of gillnetting (eight net-nights: two nights of two sinking and two floating each) and trapnetting (four net-days: two nights of two nets). Sacrificed game fish were eviscerated and iced down, then donated to a local charity organization.

No electrofishing was conducted.

Market Lake Wildlife Management Area

Electrofishing Survey

We conducted an electrofishing survey on May 3, 1995 using a drift boat electrofisher on the main ditch alongside the "M-series" wetland cells. This was one of the only areas on the WMA thought to possibly contain gamefish after a number of years of poor overwinter conditions and no gamefish introductions.

Mud Lake

Dissolved Oxygen Monitoring

We monitored dissolved oxygen concentrations during January and February 1995. A YSI DO/Temp meter was used to measure DO and water temperature at ten sites in the eastern basin of the lake (Figure 1). We also recorded water depth measurements and observations of the amount and condition of aquatic vegetation at each site.

Additionally, we plowed snow from approximately 11.3 acres of the ice surface using a half-ton 4-wheel-drive pickup truck on February 21 in an attempt to elevate DO levels via increased light penetration and photosynthesis.

Lowland Lake Survey

We conducted a standard lowland lake survey on Mud Lake June 12-13. A full complement of sampling was conducted, consisting of gillnetting (eight net-nights: two nights of two sinking and two floating each), trapnetting (four net-days: two nights of two nets) and electrofishing (two nights).

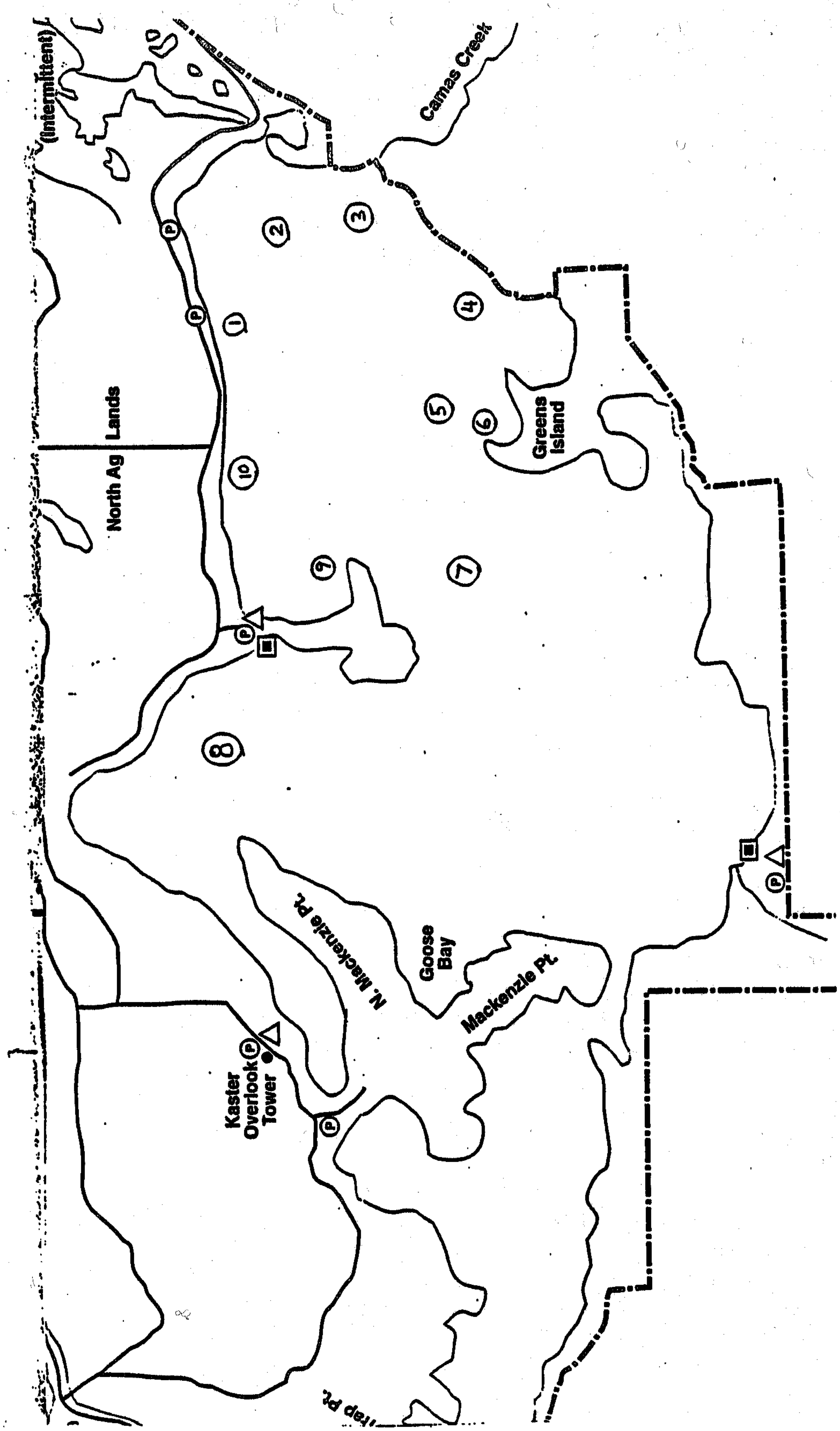


Figure 1. Dissolved oxygen standard monitoring sites (10) on Mud Lake.

Palisades Reservoir

Cutthroat Trout Information

Anecdotal information such as fishing quality, fish size, spawning run size, and timing for cutthroat trout *O. clarki* was gathered from local anglers, residents, and Department staff during the course of normal duties.

Big Elk Creek Kokanee Salmon Run

Anecdotal information such as fishing quality, fish size, spawning run size, and timing for kokanee salmon was gathered from local anglers, residents, and Department staff during the course of normal duties.

Kokanee Salmon Trawling

Kokanee salmon trawling was conducted with Fisheries Bureau staff and the Boise-based trawl boat (towing a deepwater otter trawl) on July 26-27, 1995. A total of ten multi-step trawl tows were made.

Ririe Reservoir

Bass Tournaments

The Eagle Rock Bassmasters Budweiser Bass Tournament was held July 15-16, 1995. This is the largest fishing tournament held on Ririe Reservoir annually. The two-day tournament is typically held the middle weekend of July. Catch-per-unit-effort and length frequency data were collected.

Hatchery Trout Evaluation

A small-scale evaluation of hatchery trout return rate and timing was conducted subsequent to a tagged trout tournament sponsored by several local businesses. Thirty (30) jaw-tagged (non-reward), large (300-350 mm) catchable rainbow trout *O. mykiss* were released at Ririe Reservoir June 23 with a stocking of 2,000 fish. Half of the marked and unmarked fish were released at each boat ramp (Blacktail and Juniper). Return of tags to the regional office was then monitored.

Kokanee Salmon Trawling

Kokanee salmon trawling was conducted with Fisheries Bureau staff and the Boise-based trawl boat (towing a deepwater otter trawl) on July 25, 1995. A total of seven multi-step trawl tows were made.

Roberts Gravel Pond

Lowland Lake Survey

A standard lowland lake survey was conducted on Roberts Gravel Pond in summer 1995. Limnologic and morphometric surveys were conducted concurrently. A need for a new management direction here was generated by poor fishing in recent years, despite continuous stocking of hatchery rainbow trout and introductions of various warmwater game fishes. This data gathering effort was undertaken to provide current information for use in formulating new management alternatives.

RESULTS AND DISCUSSION

Island Park Reservoir

Creel Survey

Our observations suggest that post-renovation fishing has been fair to poor for most anglers, although some do quite well. Catch rates averaged 0.4 fish/h during the four days sampled from late May to late July. This compares favorably with catch rates in the 1980s and 1990s but is well below 1960s values (range = 0.43 - 0.82, mean = 0.6 fish/h, n = 4 years) and our reservoir management goal of 0.6 fish/h (Table 1). Due to the small sample size of four days early in the season, the 1995 results may be biased but are still worth noting for trend purposes. Boat anglers continue to be more successful than bank anglers.

Table 1. Catch rates summary and total summer fishing effort estimates for Island Park Reservoir.

Year	Catch rate (trout/h)	Hours fished	Census period
1960	0.82	75,668	June 4 - October 31
1965	0.43	107,789	May 19 - October 31
1967	0.54	92,949	June - October
1968	0.59	176,008	June - October
1981	0.44	70,820	May 23 - October 31
1982	0.23	124,442	May 28 - September 30
1989	0.30	49,085	May 27 - September
1990	0.14	N/A	May 26 - July 16
1994	0.20	41,308	May 28 - August 20
1995	0.40	N/A	May - July

Kokanee Salmon Spawning Run

Observations of kokanee salmon spawners in the Upper Henrys Fork indicated large numbers of fish in the reach from Mack's Inn to Moose Creek. This spawning run is gathering a following of anglers, particularly fly-fishermen, many of whom are nonresidents and/or are guided. Local individuals also reported kokanee salmon spawners in the Henrys Lake outlet.

During the August 14-September 1 trapping period, 748 male and 513 female kokanee salmon were captured for a total of 1,261 kokanee salmon trapped at Moose Creek. Spawned females were disposed of outside the stream, and all other kokanee salmon were passed above the weir. We estimate a minimum escapement of 354 females into Moose Creek. We are confident that is a minimum number because we know that some fish passed upstream prior to, after and during the trap operation. Likewise, we are confident that total spawning escapement exceeded 1,500 fish after accounting for those kokanee salmon missed at Moose Creek, which ran up the Henrys Lake Outlet, or that were harvested somewhere above McCrea's Bridge. Measurements of kokanee salmon spawners by Ashton Hatchery personnel indicated length ranges of 450-535 mm for males and 430-495 mm for females.

Kokanee salmon eggs (213,000) taken at Moose Creek were reared to eye-up (76%) at Mackay Hatchery and then outplanted (163,000) into the gravels of Moose Creek at three sites near the Moose Creek cutoff road. The eggs were originally intended for rearing to fingerling size but that was deemed unnecessary when the Deadwood Reservoir egg taking operation became operable.

Lowland Lake Survey

Gill net effort totaled 135.7 hours while trap net effort totaled 84.75 hours. One floating gill net placed at the mouth of Trude's Bay was tampered with on August 27 and consequently fished poorly.

The proportion of gamefish (trout *Salvelinus spp.*, char, mountain whitefish *Prosopium williamsoni* and kokanee salmon) declined commensurately but was still above 60% (Figure 2). As expected, Utah sucker *Catostomus ardens* and Utah chub *Gila atraria* are increasing in both percent of the catch in gill nets and catch-per-unit effort (Table 2).

A good catch of kokanee salmon (n=15) was made but few fish were apparent in age classes older than yearling but younger than pre-spawn adult. The spawning run of 1997 should reveal whether that observation was due to low sample size.

Length frequency distributions for all species captured are listed in Appendix A.

ISLAND PARK RESERVOIR

1995 LOWLAND LAKE SURVEY

GILLNET AND TRAPNET COMPOSITION

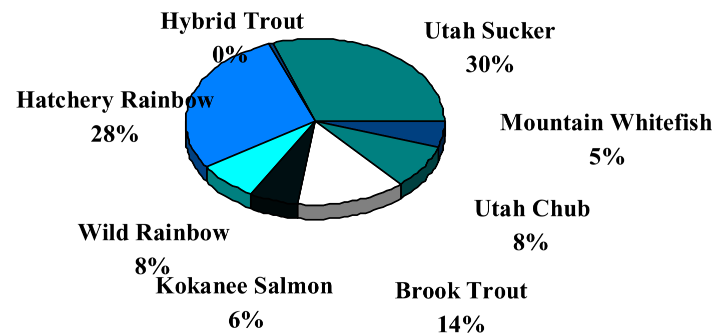


Figure 2. Species composition and relative abundance of fish captured by gill nets and trap nets, Island Park Reservoir, June 26 and 27, 1995. Total fish captured = 240 (see Appendix A).

Table 2. Trends in experimental gill net catches pre- and post-renovation at Island Park Reservoir, 1991-1995.

	Gill net catch composition		Gill net CPUE (fish/net-night)	
	% Utah sucker and chub	% gamefish	Sucker and chub	Rainbow trout
1991	92	8	--	--
1992*	90	2	68.0	--
1993*	53	47	9.0	--
1994	11	89	4.4	26.3
1995	38[b]	62	20.8	21.3

* Renovation occurred between the 1992 and 1993 sampling efforts.
[b] 8% chub, 30% sucker.

Summary

Trout and kokanee salmon stocked in Island Park Reservoir in the fall of 1992 and spring of 1993 following the rotenone renovation did not fully recruit to the reservoir fishery until the summer of 1994. Even so, the two fishing seasons fully supported by the benefits of the renovation project (1994 and 1995) did not show the level of improvement we expected in catch rates. The 1994 season catch rate of 0.2 fish/h was no better than catch rates immediately prior to the renovation. The 1995 average catch rate (0.4 fish/h) was a significant improvement but was still below the angling quality experienced in the 1960s and did not meet the statewide standard for reservoir fisheries (0.6 fish/h). However, the size of both trout and kokanee salmon in the net samples and in the creel has met our expectations for renovation benefits to reservoir productivity. Of the wild and hatchery rainbow trout in our gill net samples, 67% were 355 mm or larger and 43% of the kokanee salmon captured by gill nets were over 355 mm in length. These "large" trout and salmon were also predominating in the incidental creel checks made by fisheries and enforcement personnel. Department personnel have verified numerous reports of rainbow trout over 4 lbs and kokanee salmon over 2.5 lbs being common in the catch.

We are uncertain why improvements in reservoir catch rates have not paralleled progress in salmonid growth and size in the creel. Reservoir management may have influenced fishing success. Island Park Reservoir was maintained at close to full pool for much of the 1994 and 1995 fishing seasons. Experienced Island Park Reservoir anglers have noted that fish seem to be more widely dispersed at full or near-full pool levels, making angling more difficult, both in terms of finding concentrations of trout or salmon and in terms of logistical access to the fishery. Island Park Reservoir is primarily a boat fishery; therefore shore anglers enjoy significantly lower success.

We will continue to monitor the response of this fishery to the 1992 renovation project. Department personnel will continue unstructured creel surveys as often as possible. In 1996 we will also sample and compare zooplankton size and numbers to 1992 samples acquired immediately before the rotenone treatment as an index of salmonid forage productivity response.

Market Lake Wildlife Management Area

Electrofishing Survey

Forty-six minutes of electrofishing yielded 146 Utah chub and 70 yellow perch *Perca flavescens* (Appendix B). Many more chub (especially very small individuals) were seen but not netted. Perch condition was good to excellent, and the larger individuals were well worth an angler's time.

Mud Lake

Dissolved Oxygen Monitoring

Early onset of ice in fall 1994 coupled with an opaque crusty snow cover led to low dissolved oxygen concentrations in mid- to late winter 1995 (Appendices C and D). The low DO conditions and the lack of certain species (especially Lahontan cutthroat trout *O. c. henshawi*) in the 1995 lowland lake survey and the winter 1995-1996 ice fishery led us to suspect that a partial winterkill occurred in February and/or March 1995.

Snowplowing appeared to slightly elevate DO after three sunny days at least at one site (Appendix E); however, results were inconclusive as to whether or not the technique is a viable one. Providing some amount of winter flow down Camas Creek into the lake would almost certainly be the best prevention for winterkill, if it could be arranged in a cost-efficient and low liability agreement with the local water users.

Winter DO concentrations have been monitored since 1993 (Appendix F).

Lowland Lake Survey

Gill net effort totaled eight net-nights or 135.7 hours, while trap net effort totaled four net-nights or 86.0 hours. Actual electrofishing effort totaled 120 minutes over two nights. Species composition and relative abundance from the combined gear types were yellow perch (86%), largemouth bass *Micropterus salmoides* (1%), Utah sucker (8%), and Utah chub (5%) (Figure 3; Appendix G).

Yellow perch were most abundant in all gear types and showed good strength for 1994 and 1993 year classes (yearlings and 2+ fish) and a few larger individuals ($\geq$200 mm). Although too small to sample in most of our gears, many age 0 perch were observed, indicating presence of a 1995 year class.

Utah chub and suckers were not abundant (1.0 and 1.25 caught per gill net night). Chubs appeared to be of one size class (210-250 mm), while suckers were distributed rather evenly in a wide variety of sizes (Appendix G).

Mud Lake

Lowland Lake Survey June 12-13, 1995

All Methods

N=174

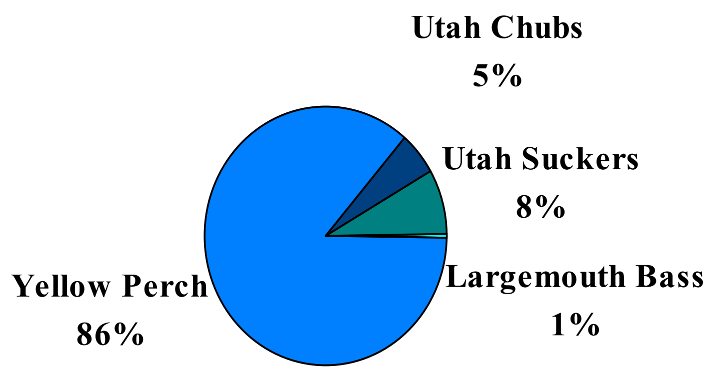


Figure 3. Species composition and relative abundance of fish captured by gill nets, trap nets, and electrofishing, Mud Lake, June 12 and 13, 1995. Total fish captured = 174 (see Appendix G).

Palisades Reservoir

Cutthroat Trout Observations

As in 1994, unusually large runs of adults in reservoir tributary streams (reported by anglers and Department personnel) indicate a possible improvement in the cutthroat trout population and fishery. It is probable that the positive change is partly due to a recent switch by the Jackson National Fish Hatchery from a long-time domesticated cutthroat trout broodstock to a first generation wild stock (BAR B-C) derived from a Snake River tributary in Wyoming.

A proposed long-term performance evaluation of the Jackson National Fish Hatchery cutthroat trout product will start in 1996 and may shed some light on this phenomenon. Return to creel and other performance parameters will be compared for the two groups of cutthroat currently stocked annually (low density-large size, high density-small size).

Big Elk Creek Kokanee Salmon Run

High water in late summer eliminated the enforcement problems encountered in 1994 with the kokanee salmon run at Big Elk Creek. If we assume that this kokanee salmon run will either maintain or increase in size, we should only expect spawn-run fishery problems in extreme low water years like 1994 when the Big Elk Creek sub-impoundment is empty or nearly so.

Department personnel working in the drainage in early September 1995 noted spawners as far upstream as Siddoway Fork in Wyoming and that adults were visible in virtually all suitable holding water in Big Elk Creek up to that point.

This spawning run has become popular for wildlife viewing and is becoming a target fishery.

Kokanee Salmon Trawling

As in 1994, the 1995 trawling effort netted no kokanee salmon but did capture a number of Mysis shrimp *Mysis relicta* on most hauls. Only two cutthroat trout and two brown trout *Salmo trutta* were captured during two nights of trawling (Table 3).

We recommend using hydroacoustics in 1996 to determine fish biomass in the reservoir and why kokanee salmon have yet to be sampled in the trawl.

Table 3. Catch of salmonids and mysids by individual trawl from Palisades Reservoir, June 26-27, 1995.

	Mysis	Cutthroat trout	Brown trout	Kokanee salmon
6/26/95				
#1	0	1 @ 395 mm		
#2	0			
#3	125	1 @ 308 mm		
#4	145			
#5	10			
#6	75			
#7	65			
6/27/95				
#1	1,300			
#2	5			
#3	0		308 mm	
			369 mm	

Ririe Reservoir

Bass Tournaments

A total of 26 boats (52 anglers) fished in the Budweiser tournament July 15-16. Catch-per-unit-effort was low but typical for the post-1992 period (Table 4). Length frequency of smallmouth bass *Micropterus dolomieu* weighed in reveals that most fish entered into competition were barely legal 12-inchers (Figure 4). This skewed size distribution reflects the current bass population structure in the reservoir. Several sublegal bass were submitted at the weigh-in.

Table 4. Summary of results from Eaglerock Bassmasters Budweiser Open tournament on Ririe Reservoir, July 15-16, 1996.

# Boats	26
# Anglers/boat	2
# Anglers	52
# Hours/day	10
# Days	2
# Hours/angler	20
# Hours	1,040
# Legal fish weighed in (≥300 mm)	54
# Sublegals released	180
Total # caught	234
Legal bass CPUE	0.052 fish/h
Sublegal bass CPUE	0.173 fish/h
All bass CPUE	0.225 fish/h
Total weight weighed in	52.66 lbs
Average weight/legal bass	0.98 lb

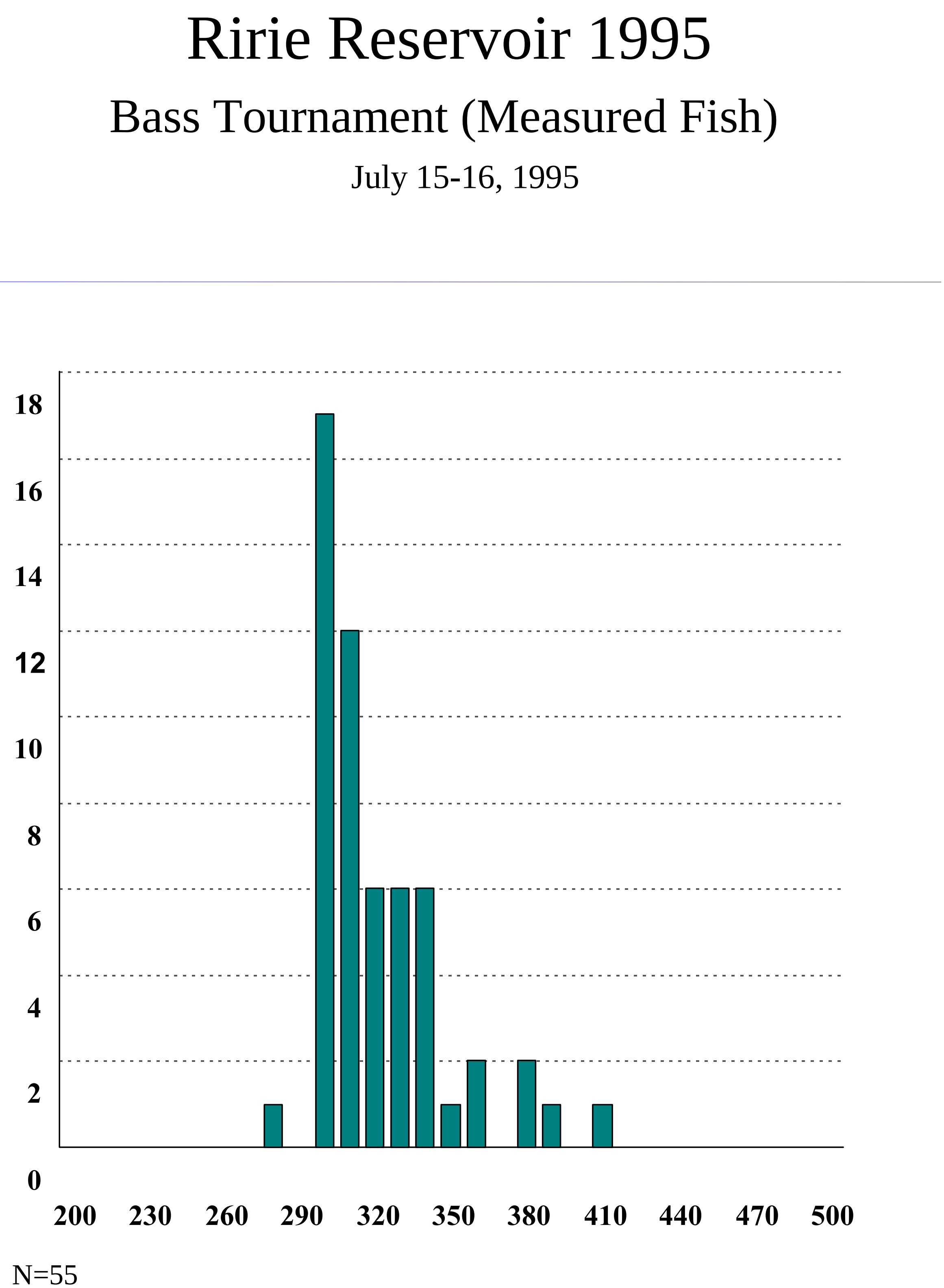


Figure 4. Length frequency distribution of smallmouth bass weighed in during the Budweiser Open bass tournament at Ririe Reservoir, July 15-16, 1995. Sample size (n) = measured fish.

It is possible that the smallmouth bass population is now at a stable level. However, with catch rates of legal fish running consistently half or less of what they were when they peaked in 1992, bass anglers are dissatisfied.

Hatchery Trout Evaluation

The tag return rate was 23% (7 of 30 tags) spread over ten weeks after stocking (Table 5). Over 50% of tags returned were captured in the first three weeks. The return rate was similar for fish stocked at both access points, indicating the suitability of each site for return to the creel. We avoided stocking from the Juniper boat ramp because of the potential for entrainment losses through the spill gates. We will reevaluate dam operations to determine if we can supplement this fishery with hatchery stocking from the Juniper boat ramp.

Assuming a 50% return rate of non-reward tags, we estimate that 46% of hatchery fish in the sample were harvested. This small evaluation will be continued with an in-depth evaluation in 1996.

Table 5. Angler tag returns from Ririe Reservoir, rainbow trout, 1995.

	Number of fish	Date caught	Release site
Week 1	1	6/25	Juniper
	1	6/29	Juniper
	0	--	Blacktail
Week 2	1	7/6	Juniper
	0	--	Blacktail
Week 3	0	--	Juniper
	1	7/9	Blacktail
Week 4	0	--	Juniper
	0	--	Blacktail
Week 5	1	7/23	Juniper
	1	7/23	Blacktail
Week 10	0	--	Juniper
	1	8/23[a]	Blacktail
Totals	4		Juniper
	3		Blacktail

Note: Seven (23%) were returned out of 30 released on 6/23.

[a] This fish was caught 5.2 miles from the Blacktail release site on Willow Creek and 2.4 miles above the slack waters of the reservoir.

Kokanee Salmon Trawling

Seven multi-step trawl tows netted 28 kokanee salmon. The kokanee salmon length frequency distribution had one major mode at 130 mm (Figure 5). We believe these were likely YOY (young-of-year) or yearling kokanee salmon stocked at Blacktail or naturally produced in Willow Creek.

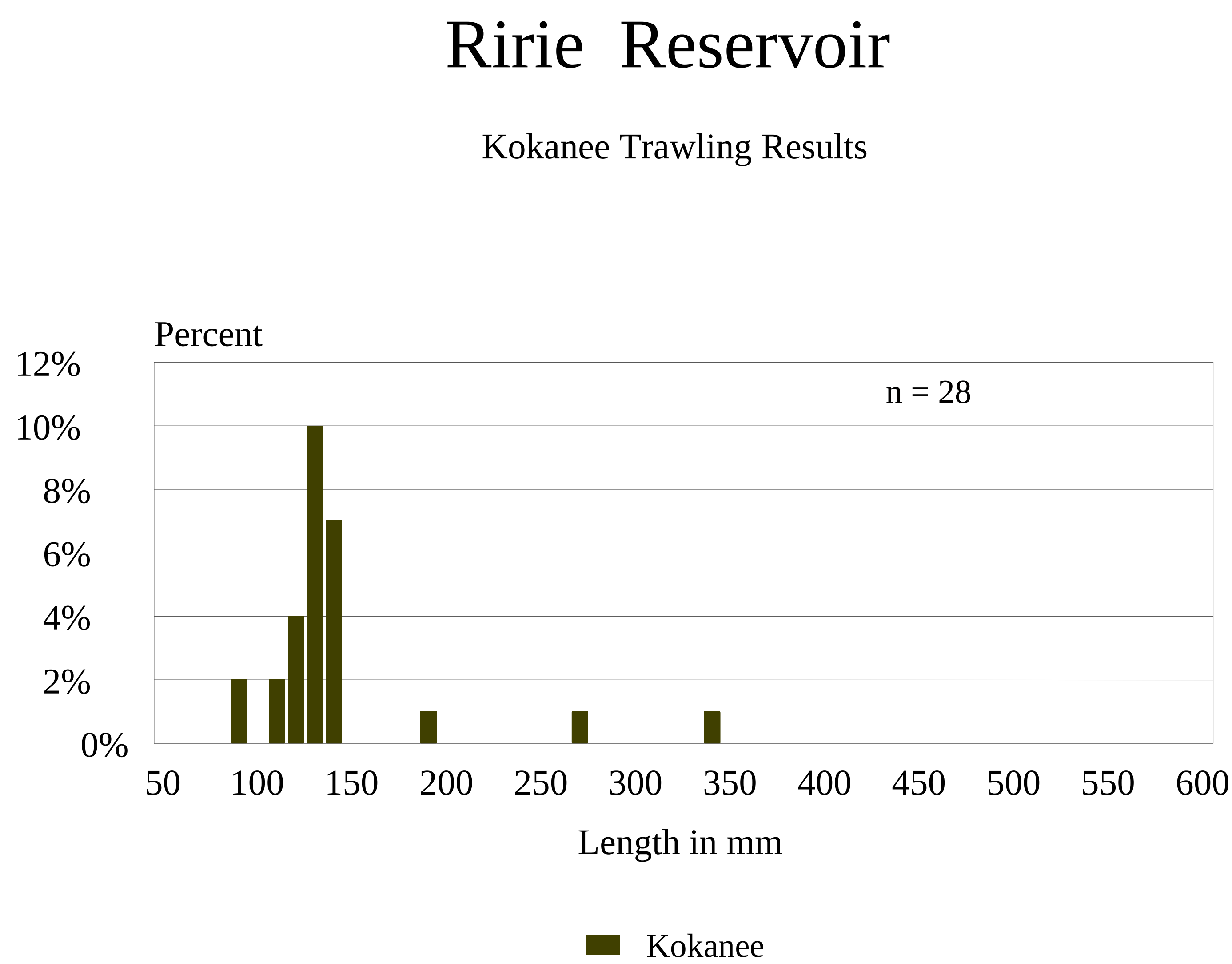


Figure 5. Length frequency distribution of kokanee salmon captured by trawling on Ririe Reservoir, July 25, 1995. Sample size = n.

Roberts Gravel Pond

Lowland Lake Survey

Temporary employees Mike Quist and Travis Horton performed this survey as an independent study through the University of Idaho fisheries program. In brief, data indicated a substandard fishery, and a recommendation to renovate the pond was subsequently adopted. A copy of that report is on file in the regional office.

RECOMMENDATIONS

1. Renovate Roberts Gravel Pond in late winter or early spring 1996; restock with catchable rainbow trout; evaluate for introduction of other fish species and of crayfish as a vegetation control agent and as forage fish (a large prey package which could serve as a direct link between primary production by aquatic macrophytes and fish flesh production).

2. Conduct a creel survey at Palisades Reservoir to evaluate contribution of various sizes of cutthroat trout stocked out of Jackson National Fish Hatchery.

3. Conduct a comparative evaluation of Mackay and Hagerman hatcheries' large (300-350 mm) rainbow trout for their relative contribution to the Ririe Reservoir fishery.

4. Begin a multi-year evaluation of the performance of large (>300 mm) splake *Salvelinus namaycush X fontinalis* in the Ririe Reservoir fishery.

5. Sample and describe the zooplankton community of Island Park Reservoir to expand our post-renovation database and evaluation of fishery benefits from the 1992 rotenone renovation.

ACKNOWLEDGMENTS

We appreciate the efforts of Travis Horton, Becky Lish, Mike Quist, and Clint Rasmussen who collected and/or entered much of the data in this report.

APPENDICES

Appendix A. Lowland Lake Survey Results, Island Park Reservoir, 1995.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
COVER SHEET

LAKE/RESERVOIR NAME: Island Park Reservoir **REGION:** Upper Snake

DATE: 6/26 - 6/27/97 **SAMPLE CREW:** Travis Horton, Michael Quist

SCALE ENVELOPE NUMBERS: ____________________ to ________________________

SAMPLING CONDITIONS:

Water Temp. (^{o}C @ .5 m): NA Air Temp. Range (^{o}C): 9^{o}C to 19^{o}C

Secchi Range (m): NA to NA

Wind (may circle more than one): 0-10 10-20 20+ mph

N NE E SE S SW W NW

SAMPLING EFFORT:

Combined floating and sinking gill net: 2 nights

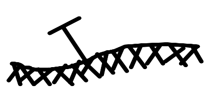
Electrofishing: NA hours; trap net: 2 nights

Other (including add l size selective sampling): ____

SAMPLING LOCATIONS:

Draw or attach a lake/reservoir map and indicate fisheries and limnological sampling locations; footnoting with narrative if necessary.

KEY:



Trap Net

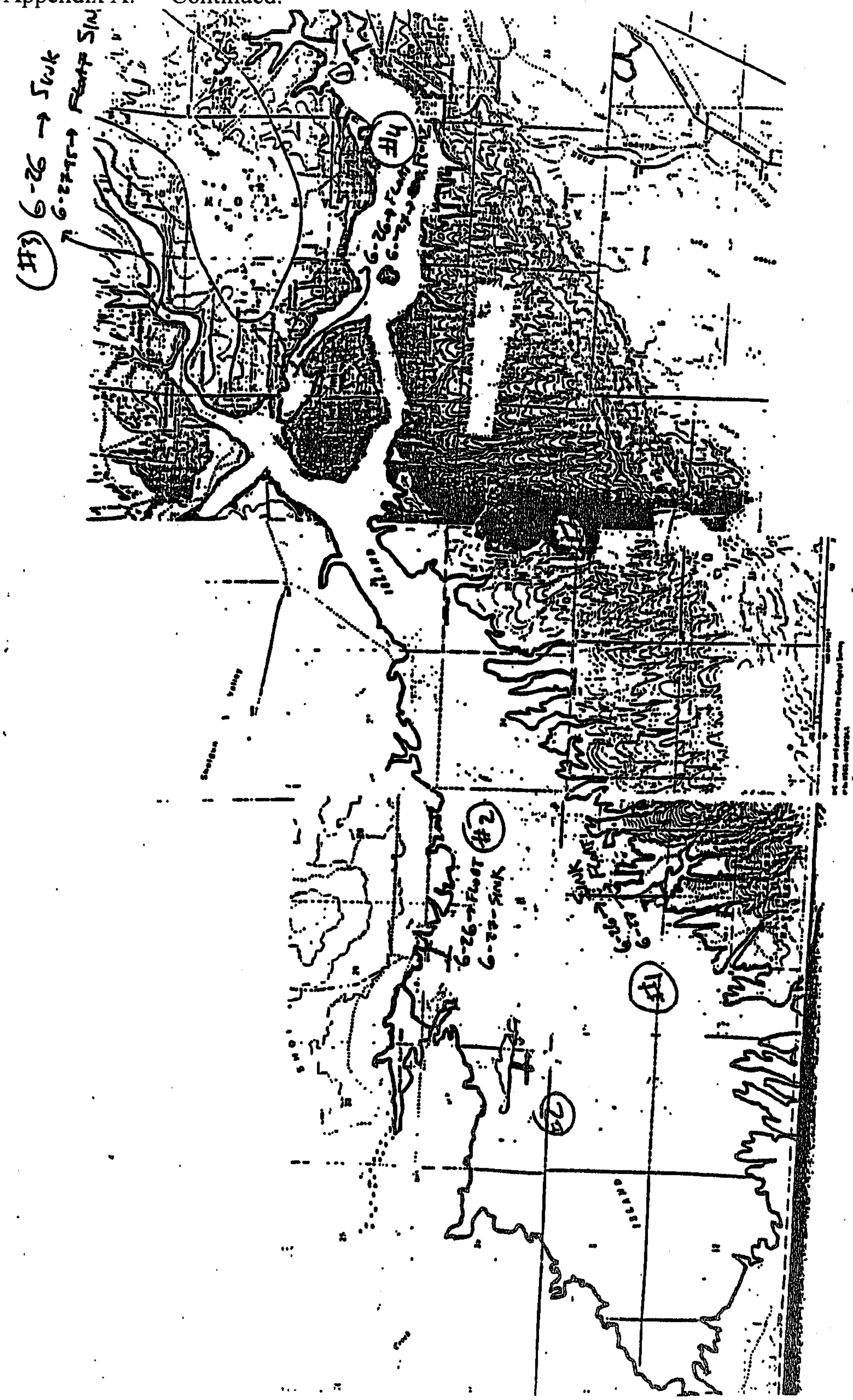
S-X Secchi reading

Gill Net (F,S,FS)

TDO-X Surface/bottom and profile readings

Electrofishing

Appendix A. Continued.



Map of Island Park Reservoir.

Appendix A. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (1 of 4)

LAKE/RESERVOIR NAME: Island Park Reservoir REGION: Upper Snake
DATE: 6/27/95 SAMPLE CREW LEADER: B. Rich (Horton / Quist)

Length range	Species hatchery rainbow trout				Species wild rainbow trout			
(mm)	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
350-450	26				11			
450-500	1							
> 500	1				3			
110-119								
120-129								
130-139								
140-149	1							
150-159	1							
160-169	1							
170-179	4							
180-189	2							
190-199	4							
200-209	1							
210-219	2							
220-229	1				1			
230-239								
240-249								
250-259								
260-269	1							
270-279								
280-289	1							
290-299					1			
300-309	1							
310-319	5							
320-329	6							
330-339	5				2			
340-349	2							
Batch Samples								
Size Range								
Numbers	67				18			
Total Weight								

Appendix A. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (2 of 4)

LAKE/RESERVOIR NAME: Island Park Reservoir REGION: Upper Snake
DATE: 6/27/95 SAMPLE CREW LEADER: B. Rich (Horton / Quist)

Length range (mm)	Species brook trout				Species kokanee salmon			
	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
350-450					5			
450-550					3			
110-119					3			
120-129					2			
130-139					1			
140-149								
150-159	1							
160-169								
170-179								
180-189								
190-199								
200-209	2							
210-219	5							
220-229	4							
230-239	1							
240-249	3							
250-259	1							
260-269	4							
270-279	5							
280-289	1							
290-299					1			
300-309	2							
310-319	2							
320-329	2							
330-339								
340-349								
Batch Samples								
Size Range								
Numbers	33				15			
Total Weight								

Appendix A. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (3 of 4)

LAKE/RESERVOIR NAME: Island Park Reservoir REGION: Upper Snake
DATE: 6/27/95 SAMPLE CREW LEADER: B. Rich (Horton / Quist)

Length range (mm)	Species Utah sucker				Species Utah chub			
	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
350-359	5							
360-369	5							
370-379	4							
> 380	5							
110-119					16			
120-129								
130-139								
140-149						1		
150-159	4	1						
160-169	6				1			
170-179	4	3						
180-189	1				1			
190-199								
200-209	2							
210-219	1							
220-229		2						
230-239	2							
240-249	1				1			
250-259		1						
260-269	2							
270-279	1							
280-289								
290-299	5	1						
300-309								
310-319	3	1						
320-329	2							
330-339	5							
340-349	6							
Batch Samples								
Size Range								
Numbers	64	9			19	1		
Total Weight								

Appendix A. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (4 of 4)

LAKE/RESERVOIR NAME: Island Park Reservoir REGION: Upper Snake
DATE: 6/27/95 SAMPLE CREW LEADER: B. Rich (Horton / Quist)

Length range (mm)	Species mountain whitefish				Species rainbow x cutthroat trout			
	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
> 380	7				1			
110-119								
120-129								
130-139								
140-149								
150-159								
160-169								
170-179								
180-189								
190-199								
200-209								
210-219								
220-229								
230-239								
240-249								
250-259								
260-269								
270-279								
280-289								
290-299	2							
300-309								
310-319	1							
320-329	1							
330-339								
340-349	1							
Batch Samples								
Size Range								
Numbers	12				1			
Total Weight								

Appendix B. Electrofishing Survey Results, Market Lake, 1995.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
COVER SHEET

LAKE/RESERVOIR NAME: Market Lake **REGION:** Upper Snake

DATE: 5/03/95 **SAMPLE CREW:** Bruce Rich

SCALE ENVELOPE NUMBERS: ____________________ to ________________________

SAMPLING CONDITIONS:

Water Temp. (^{O}C @ .5 m): _____ Air Temp. Range (^{O}C): _____ to

Secchi Range (m): _____ to

Wind (may circle more than one): 0-10 10-20 20+ mph

N NE E SE S SW W NW

SAMPLING EFFORT:

Combined floating and sinking gill net: _____ nights

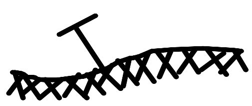
Electrofishing: .75 hours; trap net: _____ nights

Other (including add l size selective sampling): ____

SAMPLING LOCATIONS:

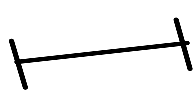
Draw or attach a lake/reservoir map and indicate fisheries and limnological sampling locations; footnoting with narrative if necessary.

KEY:



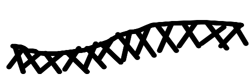
Trap Net

S-X Secchi reading



Gill Net (F,S,FS)

TDO-X Surface/bottom and profile readings



Electrofishing

Appendix B. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (1 of 1)

LAKE/RESERVOIR NAME: Market Lake REGION: Upper Snake
DATE: 5/03/95 SAMPLE CREW LEADER: B. Rich

Length range (mm)	Species yellow perch				Species Utah chub			
	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
< 79							47	
80-89							14	
90-99							14	
100-109			12				16	
110-119			15				30	
120-129			4				15	
130-139			1				7	
140-149			1				2	
150-159			1					
160-169			2					
170-179			2					
180-189			4					
190-199			17					
200-209			9					
210-219			1				1	
220-229			1					
230-239								
240-249								
250-259								
260-269								
270-279								
280-289								
290-299								
300-309								
310-319								
320-329								
330-339								
340-349								
Batch Samples								
Size Range								
Numbers			70				146	
Total Weight								

Appendix C. Dissolved oxygen readings and associated observations, Mud Lake, January-February 1995.

Mud Lake Dissolved Oxygen Levels
1995

Readings taken 1/27/95
Snow Depth 3"
Ice thickness 18"
Water depth is from bottom of ice to lake bed

Hole #	DO(ppm) top	DO (ppm) mid	DO (ppm) bottom	Total depth (m)
1	8.50	8.00	6.00	1.3
2	0.85	0.80	0.50	1.7
3	7.50	7.00	5.50	1.6
4	3.30	1.50	0.13	1.0
5	0.40	0.04	0.02	1.2
6	1.50		3.00	1.0
7	0.75	0.20	0.03	1.5
8	1.10		1.00	0.5
9	16.00		11.40	0.5
10	14.00	14.00	8.00	1.0

Hole #	Information
1	Water murky, barely able to see bottom, caught 1 perch
2	Water clear, able to see bottom, no fish seen
3	Water murky, no smell, no fish seen
4	No vegetation or fish visible, bottom not visible
5	Water smells bad, dead vegetation seen, no fish seen
6	No fish seen, no smell to water
7	No fish seen, no smell to water
8	Water clear, no fish seen, very shallow
9	Water muddy, auger hit bottom
10	Water very murky

Appendix C. Continued.

Mud Lake Dissolved Oxygen Levels
1995

Readings taken 2/01/95
Snow Depth 3"
Ice thickness 18"
Water depth is from bottom of ice to lake bed

Hole #	DO(ppm) top	DO (ppm) avg.	DO (ppm) bottom	Total depth (m)
1	6.80	5.85	4.9	1.3
2	1.40	1.05	0.7	1.7
3	5.50	3.85	2.2	1.6
4	1.90	1.15	0.4	1.0
5	0.90	0.60	0.3	1.2
6	1.80	1.50	1.2	1.0
7	1.00	0.65	0.3	1.5
8	0.75	0.625	0.5	0.5
9	11.90			0.5
10	8.60	6.45	4.3	1.0

Cloudy all day and cloudy for the previous 5 - 6 days

Mud Lake Dissolved Oxygen Levels
1995

Readings taken 2/16/95
Snow Depth 3"
Ice thickness 18"
Water depth is from bottom of ice to lake bed

Hole #	DO (ppm) top	DO (ppm) avg.	DO (ppm) bottom	Total depth (m)
1	5.50	4.30	3.10	1.3
2	1.70	1.70	1.70	1.7
3	0.40	2.80	5.20	1.6
4	1.75	1.75	1.75	1.0
5	0.40	0.08	0.12	1.2
6	1.25	1.00	0.75	1.0
7	2.75	1.68	0.60	1.5
8	4.60	2.95	1.30	0.5
9	15.90	14.9	13.90	0.5
10	11.50	8.70	5.90	1.0

Mud Lake Dissolved Oxygen Levels
1995

Readings taken 2/21/95
Snow Depth 2"
Ice thickness 18" - 24"
Water depth is from bottom of ice to lake bed

Hole #	DO (ppm) top	DO (ppm) avg.	DO (ppm) bottom	Total depth (m)
1	5.70	4.70	3.70	1.30
2	2.25	1.48	0.70	1.70
3	5.50	4.10	2.70	1.60
4	1.50	1.95	2.40	1.00
5	0.70	0.55	0.40	1.20
6	1.50	1.38	1.25	1.00
7	1.05	0.66	0.27	1.50
8				0.50
9	15.40	14.30	13.20	0.50
10	5.40	4.75	4.10	1.00

Plowed 13.5 miles (13.5 acres)

Appendix C.   Continued.

Mud Lake Dissolved Oxygen Levels
1995

Readings taken 2/22/95
Snow Depth 1"
Ice thickness 18" - 24"
Water depth is from bottom of ice to lake bed

Hole #	DO (ppm) top	DO (ppm) avg.	DO (ppm) bottom	Total depth (m)
A	0.50	0.38	0.25	
B	0.75	0.43	0.10	
C	0.50	0.30	0.10	
D	6.00	5.38	4.75	
E	6.00	4.65	3.30	
F	6.00	4.90	3.80	
G	9.25	7.63	6.00	
H	6.00	5.75	5.50	
I	0.75	0.63	0.50	
J	8.10	6.80	5.50	

Plowed 38 miles (38 acres)
Light readings taken late in the day and at long periods of time between each reading

<u>Light readings on bottom</u>
Plowed - 28.64
Plowed - 242.7

Unplowed - 119.03
Unplowed - 98.74
Unplowed - 120.57
Unplowed - 227.8
Unplowed - 222.4

Appendix C. Continued.

Mud Lake Dissolved Oxygen Levels
1995

Readings taken 2/24/95
Less than 1" of actual snow (snow & ice mix)
Ice Depth 18"- 24"

Hole #	DO (ppm) top	DO (ppm) avg.	DO (ppm) Bottom	Total depth (m)
1	6.40	5.45	4.50	1.3
2	2.50	1.59	0.68	1.7
3	8.30	6.85	5.40	1.6
4	3.70	3.25	2.80	1.0
5	0.89	0.60	0.30	1.2
6	1.50	1.15	0.80	1.0
7	2.50	2.15	1.80	1.5
8	6.50	4.40	2.30	0.5
9	15.50	12.75	10.00	0.5
10	9.90	7.60	5.30	1.0
A	0.50	0.30	0.10	
B	0.60	0.50	0.40	
C	4.50	4.30	4.10	
D	0.80	0.65	0.50	
E	6.30	5.00	3.70	
F	9.80	8.10	6.40	
G	8.60	7.30	6.00	
H	6.10	5.60	5.10	
I	0.85			
J	8.40	7.00	5.60	
K	6.40	5.75	5.10	
L	8.30	6.95	5.60	
M	0.50	0.49	0.47	
N	10.30	7.40	4.50	1.5
O	8.60	6.90	5.20	

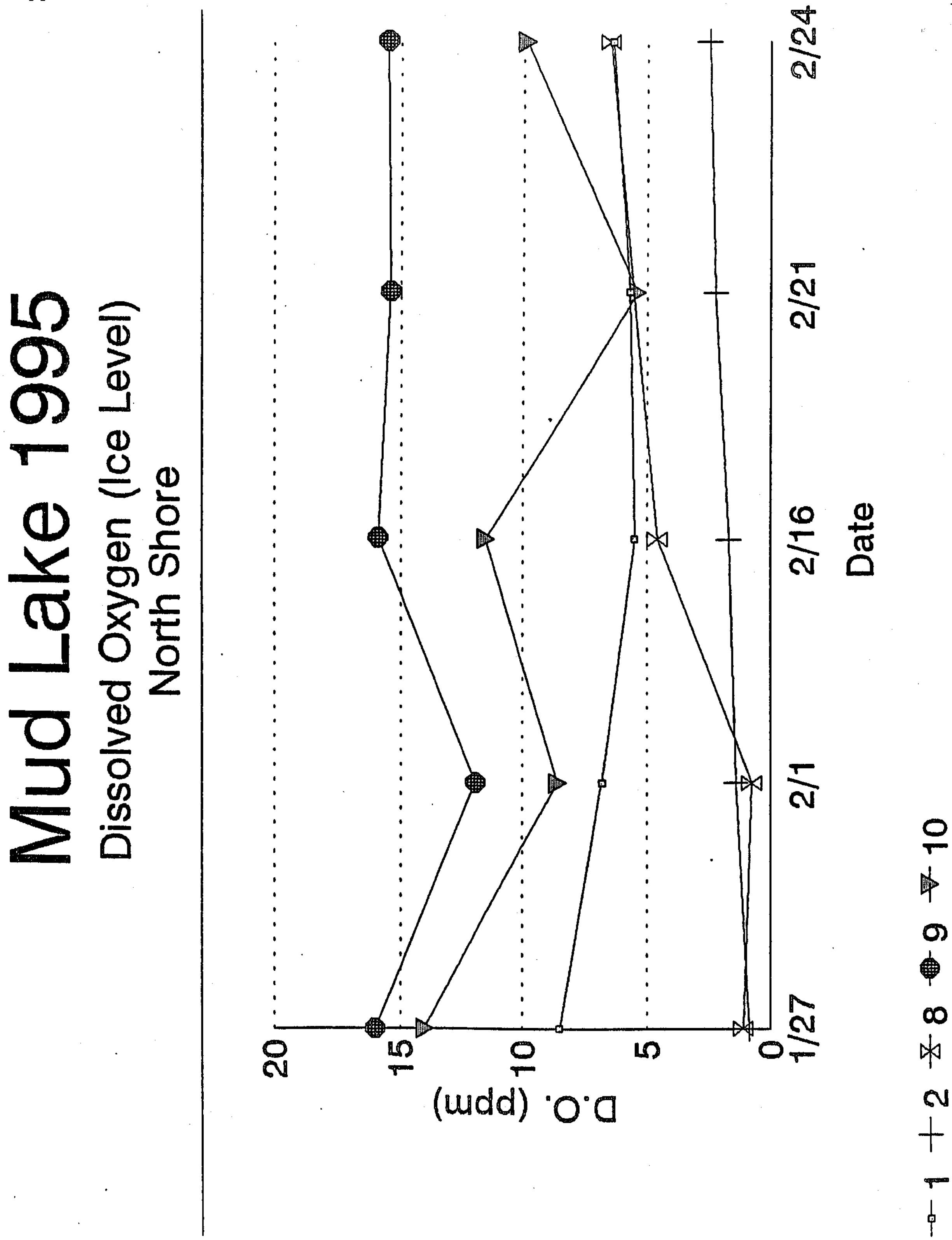
Appendix C. Continued.

Hole #	Information
3	Water cloudy with green vegetation observed
7	Water murky
8	Water clear
9	Water murky
10	Water murky, vegetation brown
A	Water murky, vegetation green
E	Water murky
F	Water clear, no vegetation present
G	Water murky
H	Water clear
I	Water clear
J	Water clear
K	Water clear, vegetation brown
L	Water clear, vegetation brown
M	Water murky, water smells
N	Water murky, vegetation green
O	Water clear

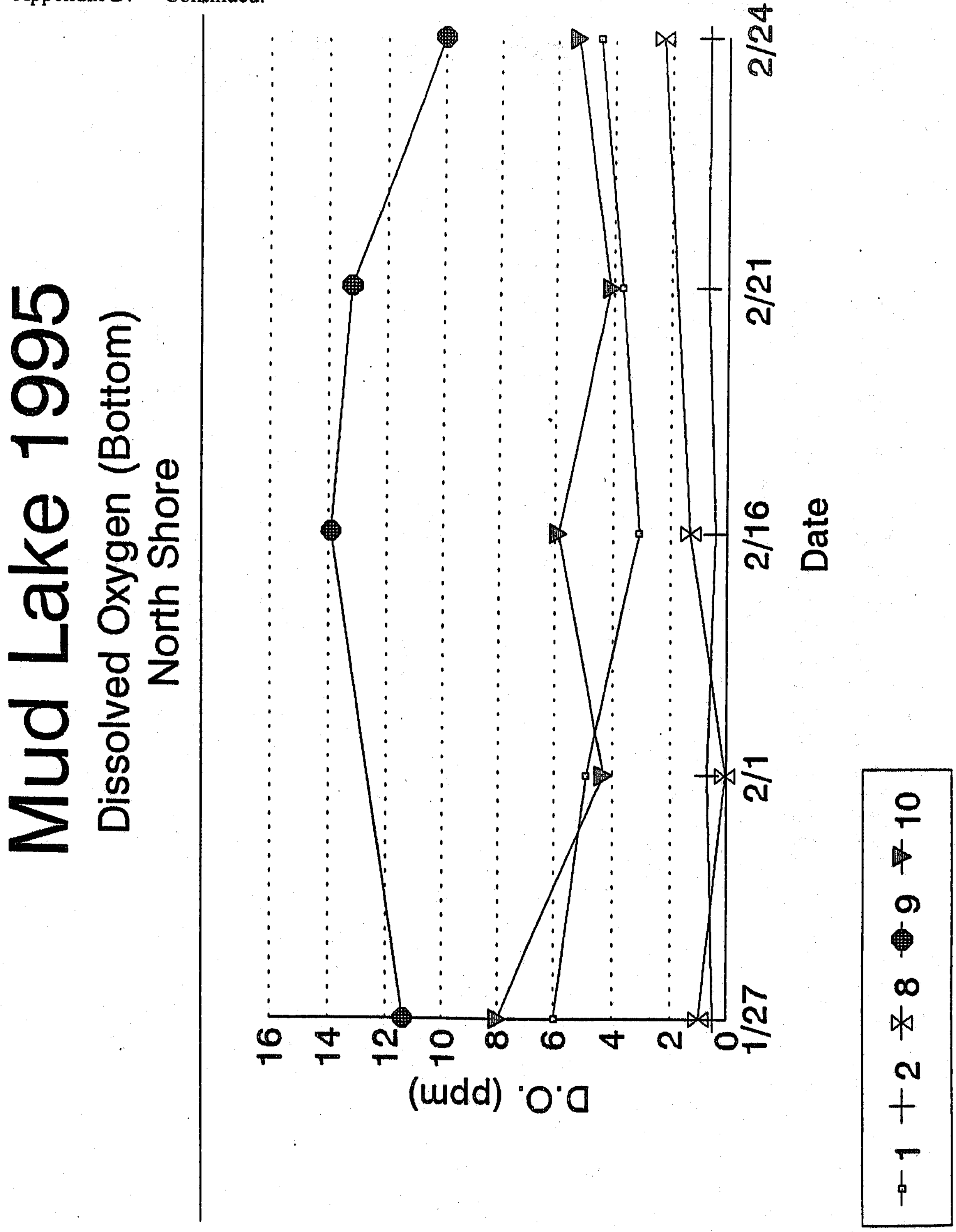
approximately 2000 snow geese sitting on the ice

Appendix D. Graphic presentations of dissolved oxygen readings Mud Lake, January - February, 1995 (grouped by location and depth in water column).

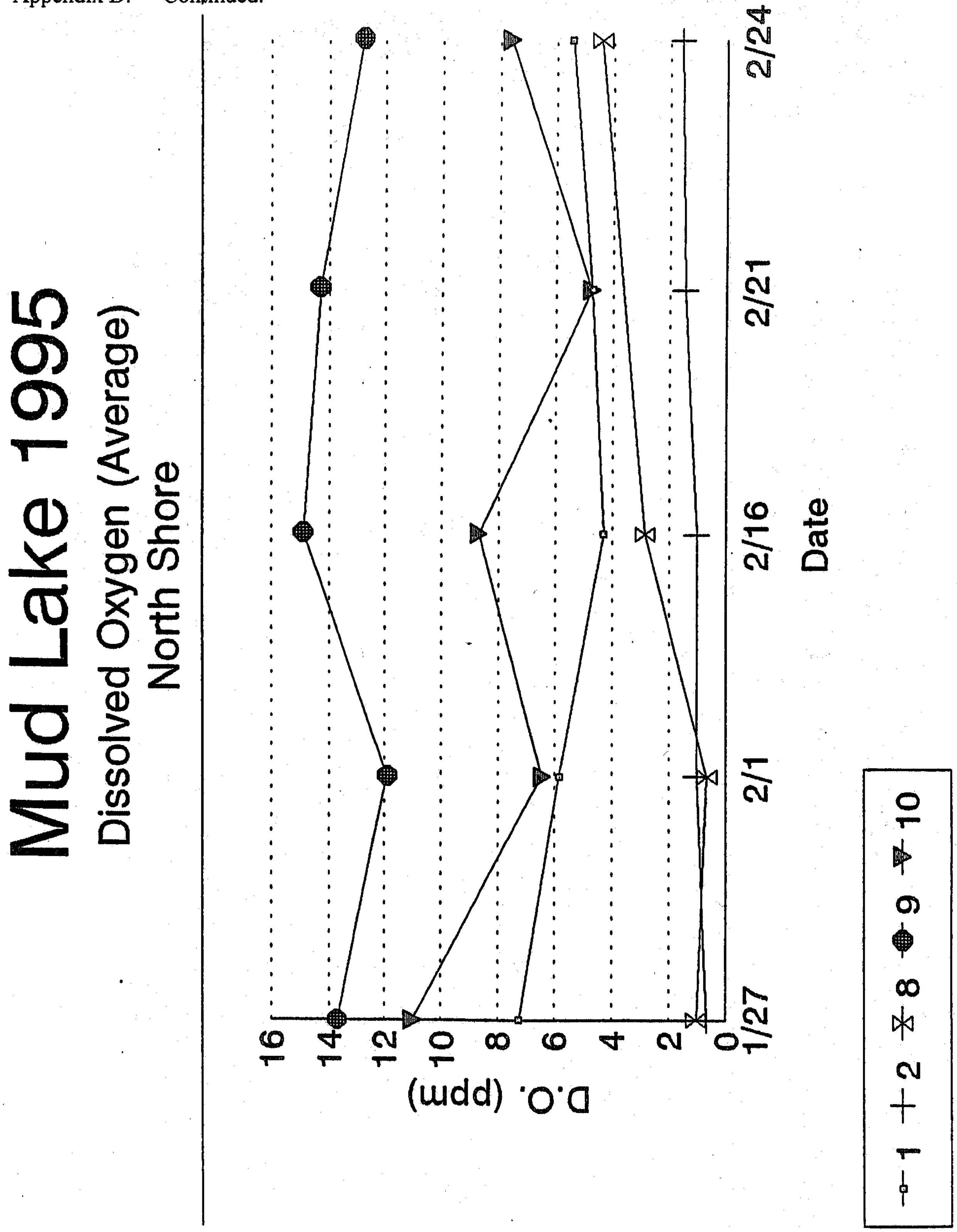
Appendix D. Continued.



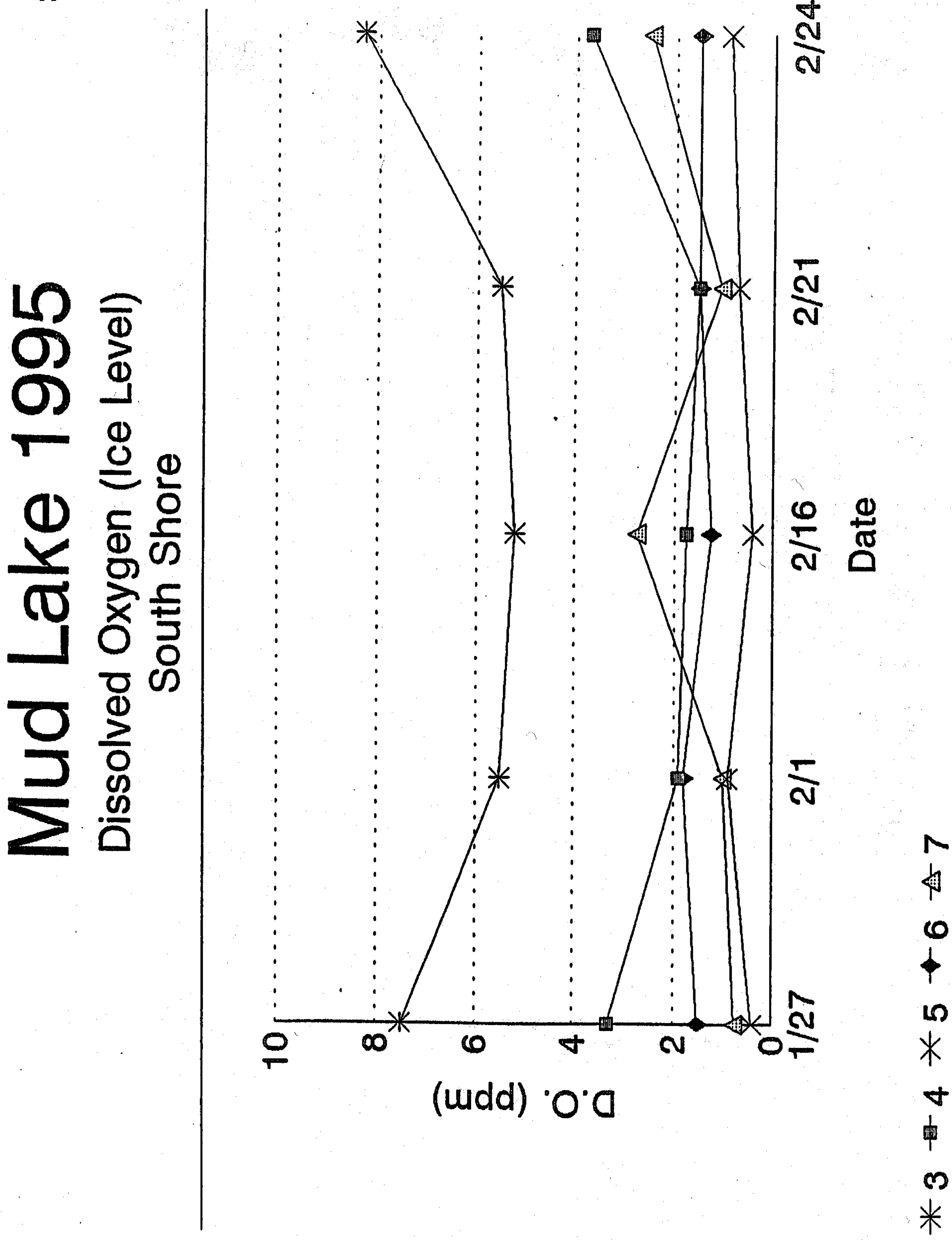
Appendix D. Continued.



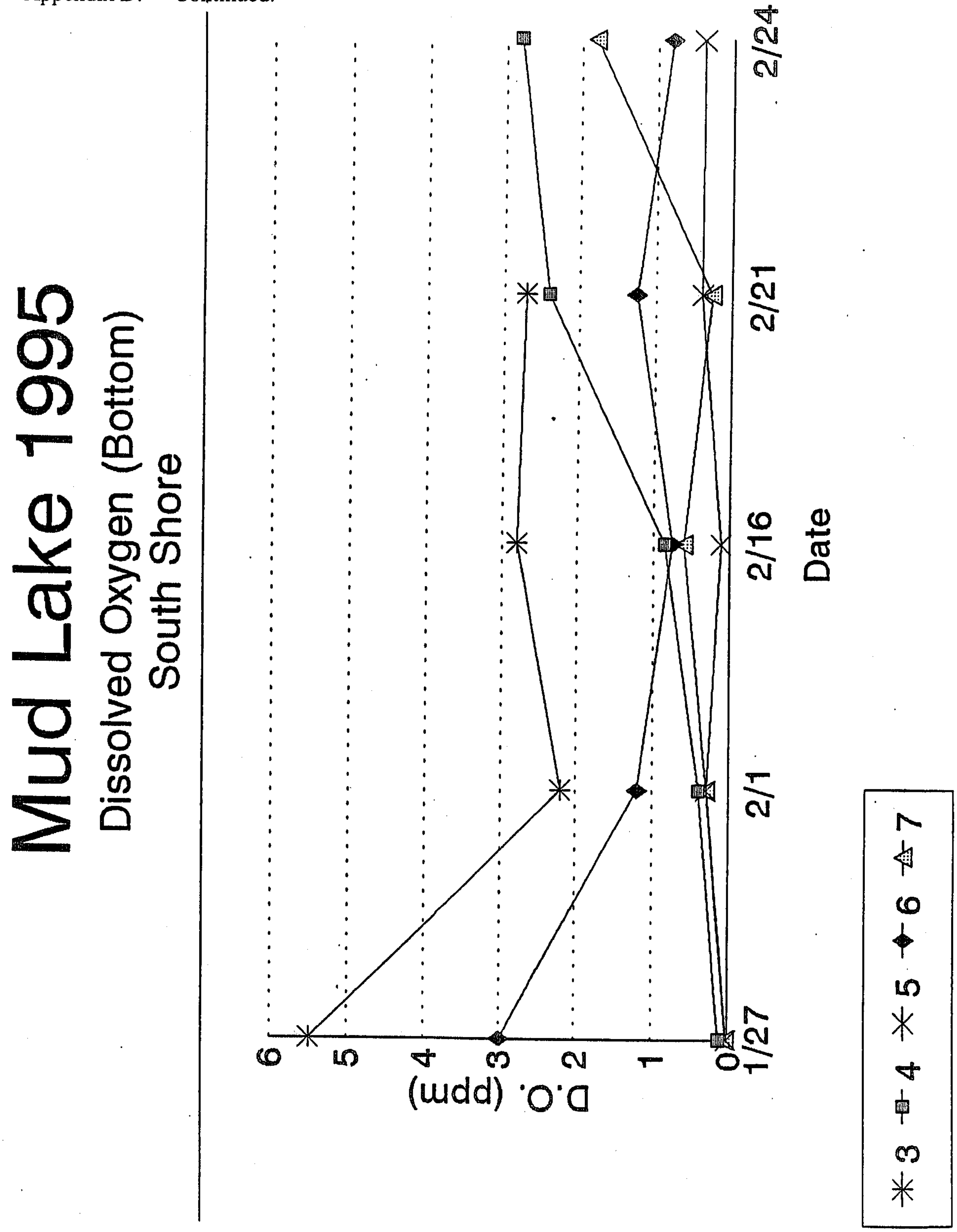
Appendix D. Continued.



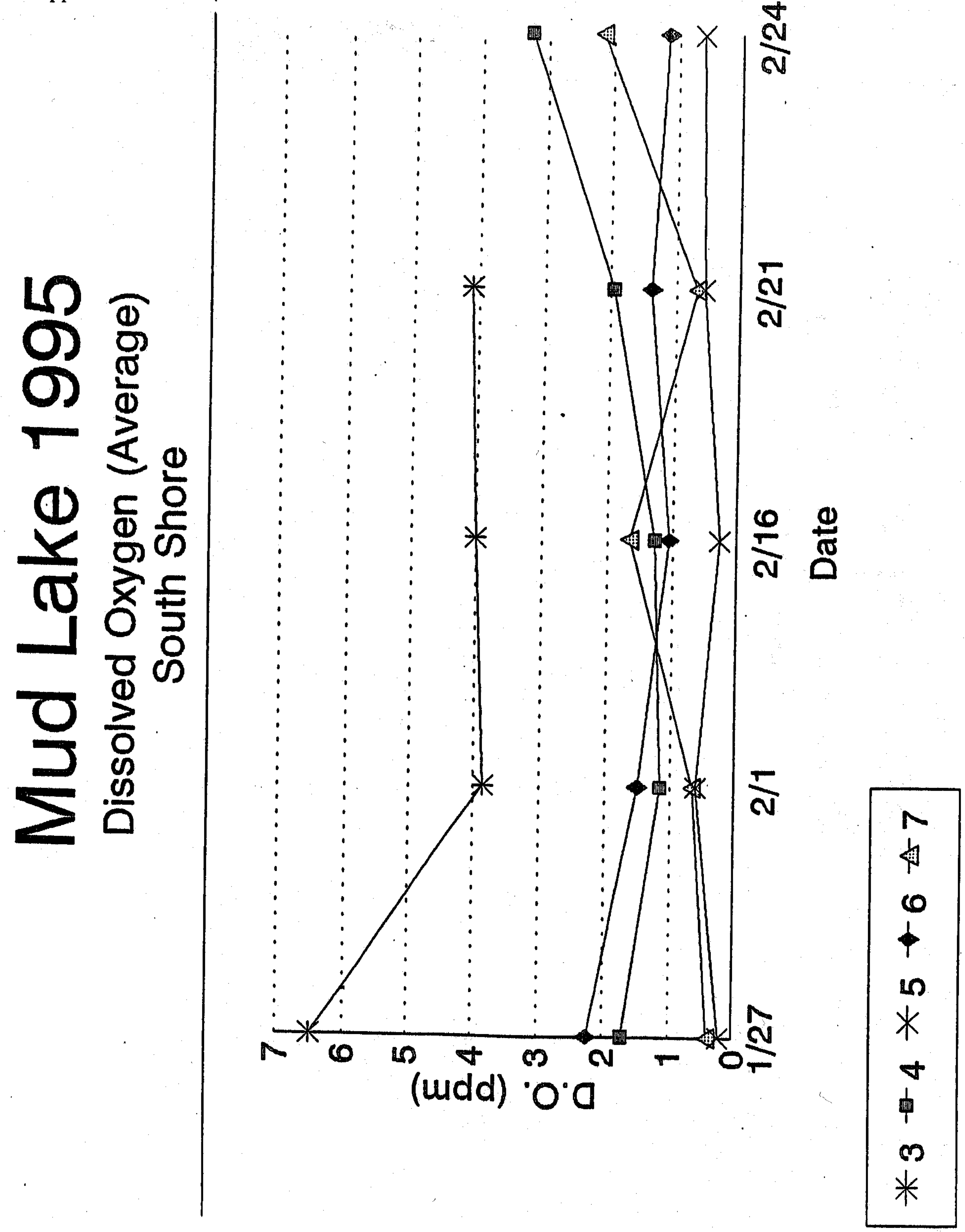
Appendix D. Continued.



Appendix D. Continued.

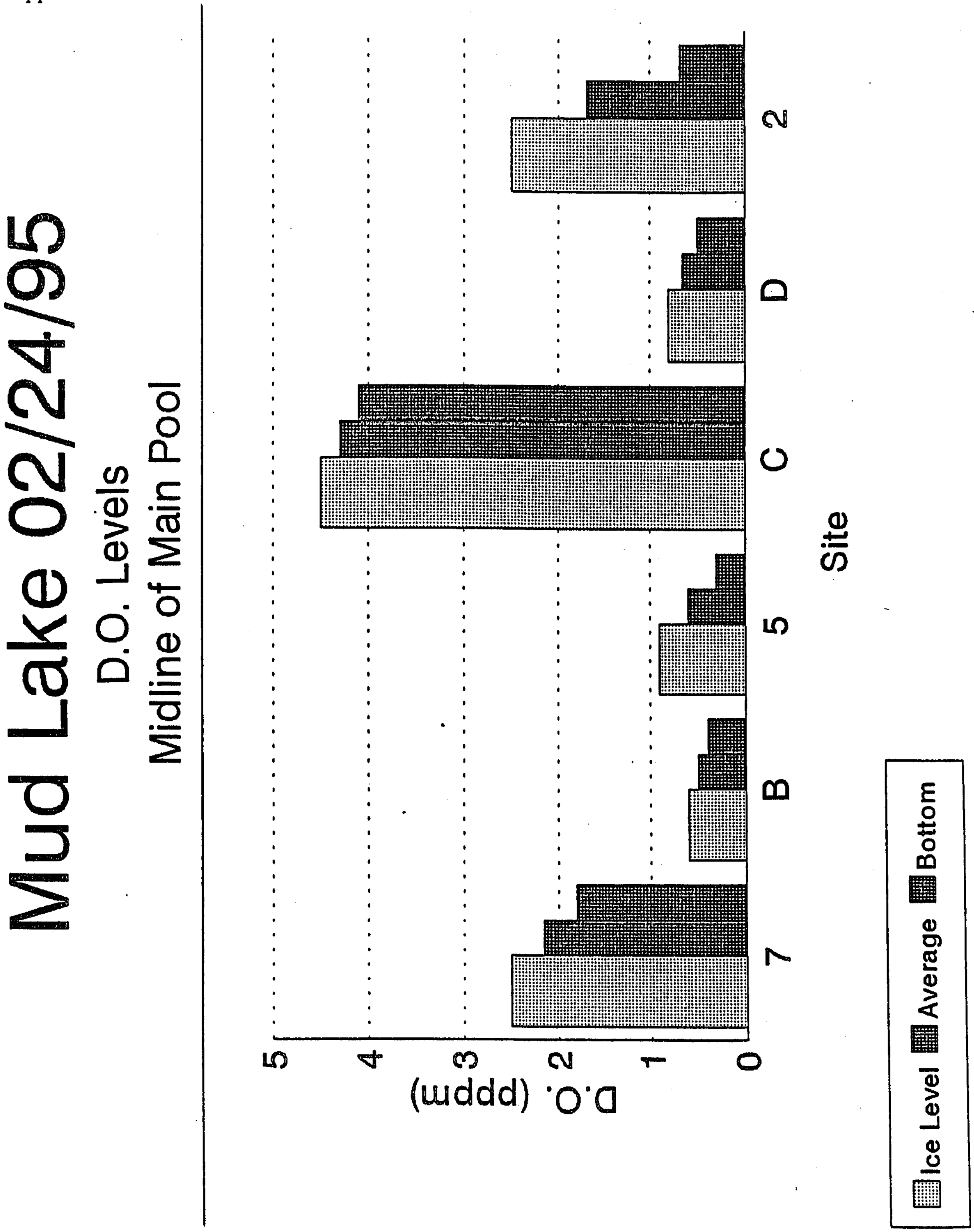


Appendix D. Continued.

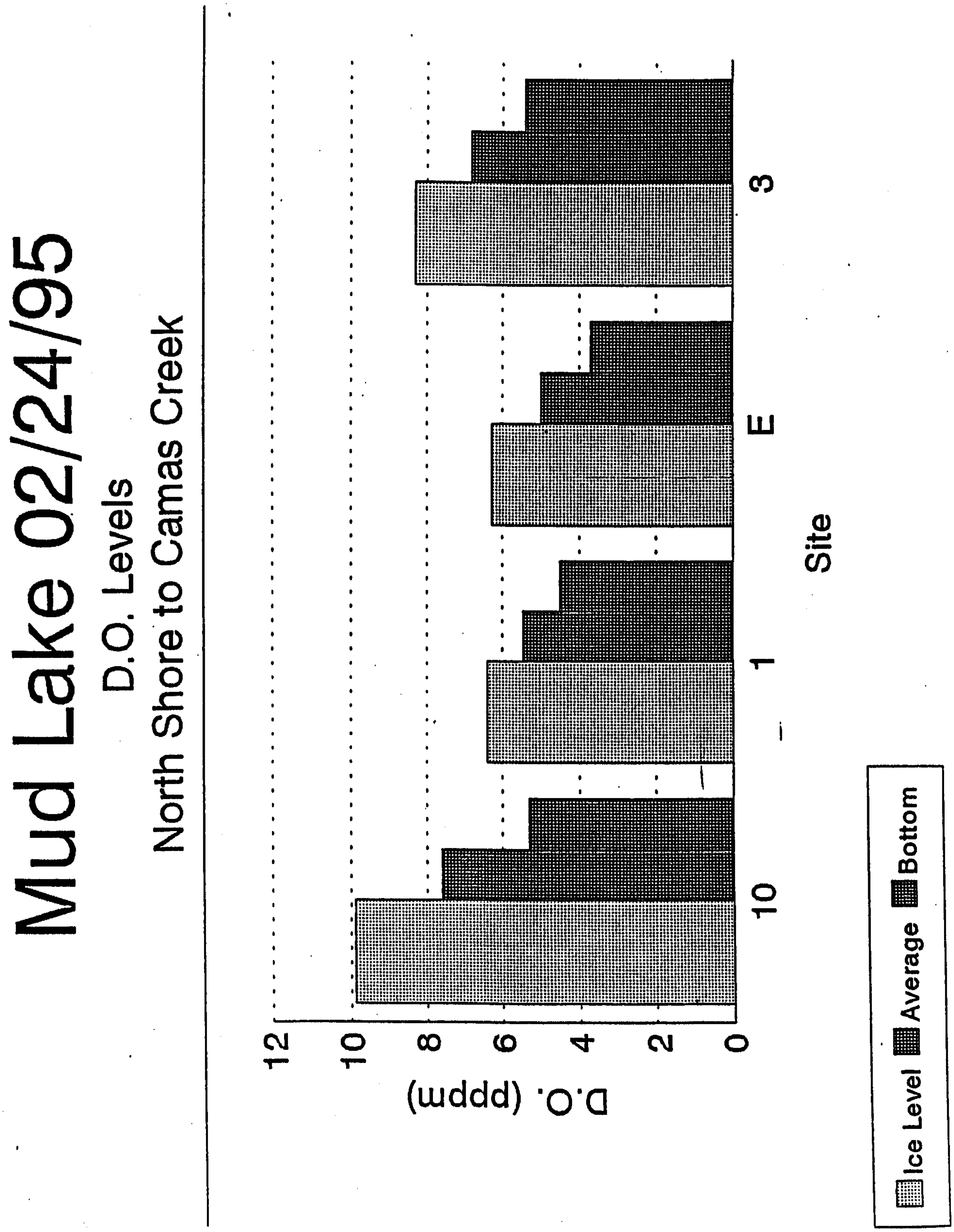


Appendix E. Graphic summaries of dissolved oxygen readings three days after snow plowing, Mud Lake, February 24, 1995.

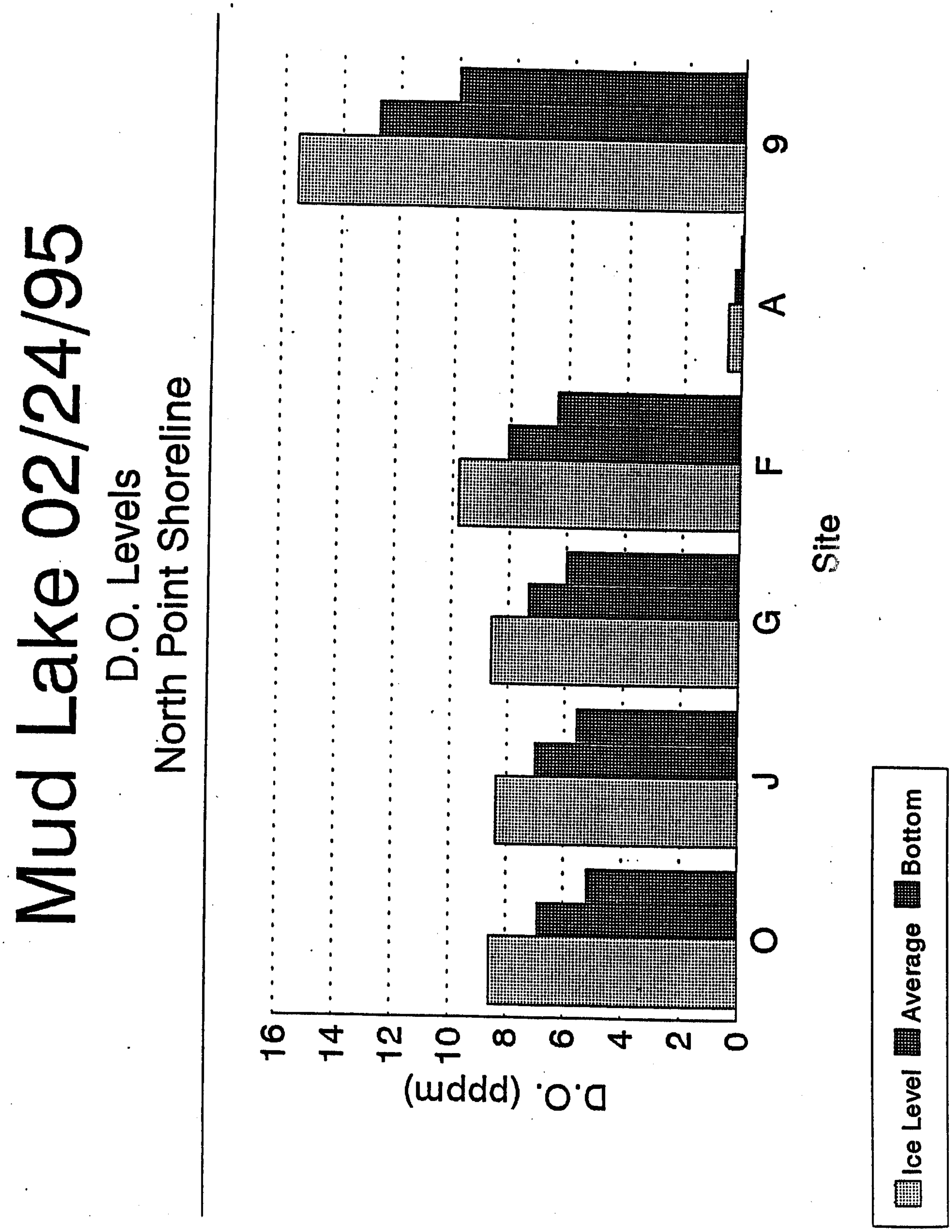
Appendix E.   Continued.

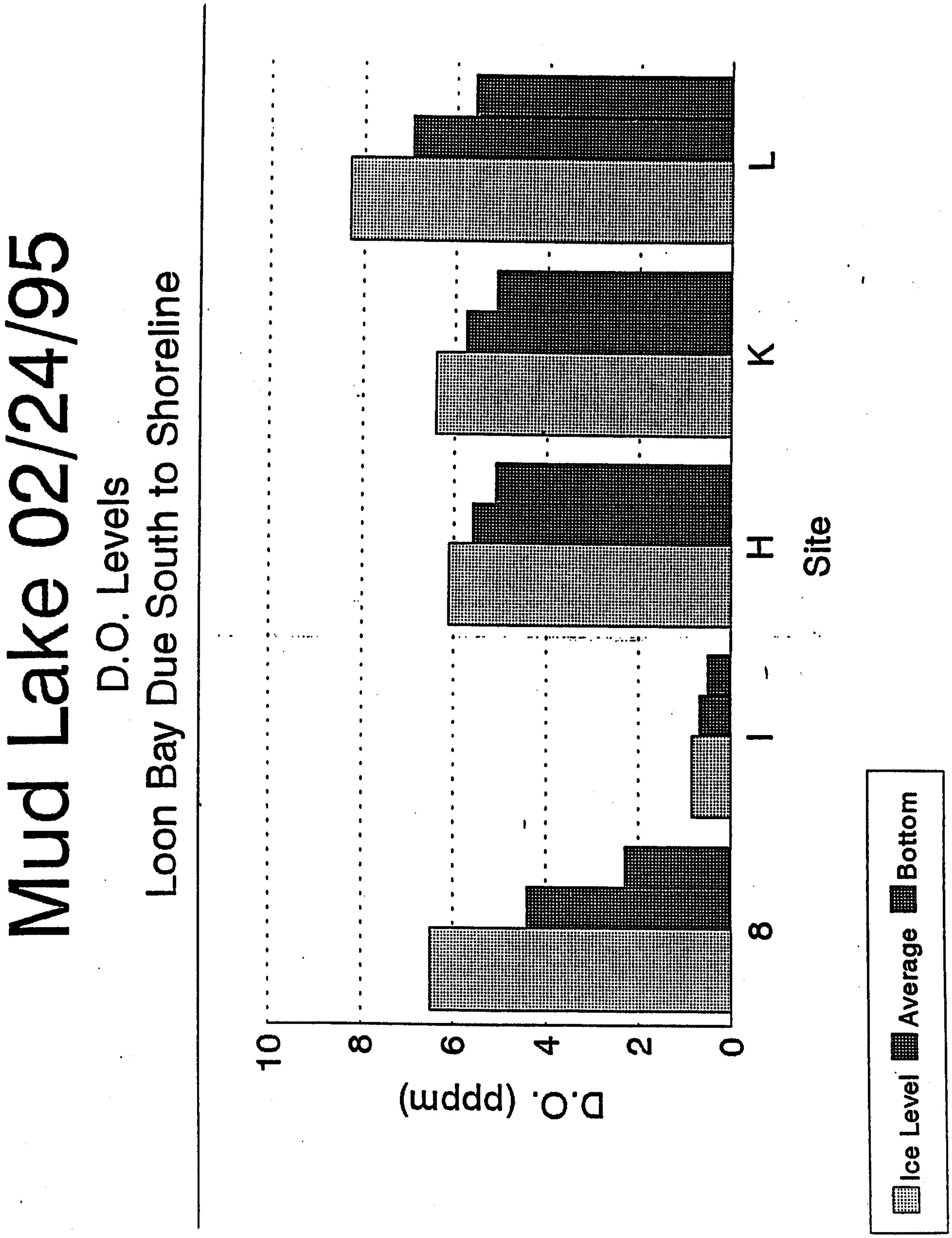


Appendix E.   Continued.



Appendix E.   Continued.

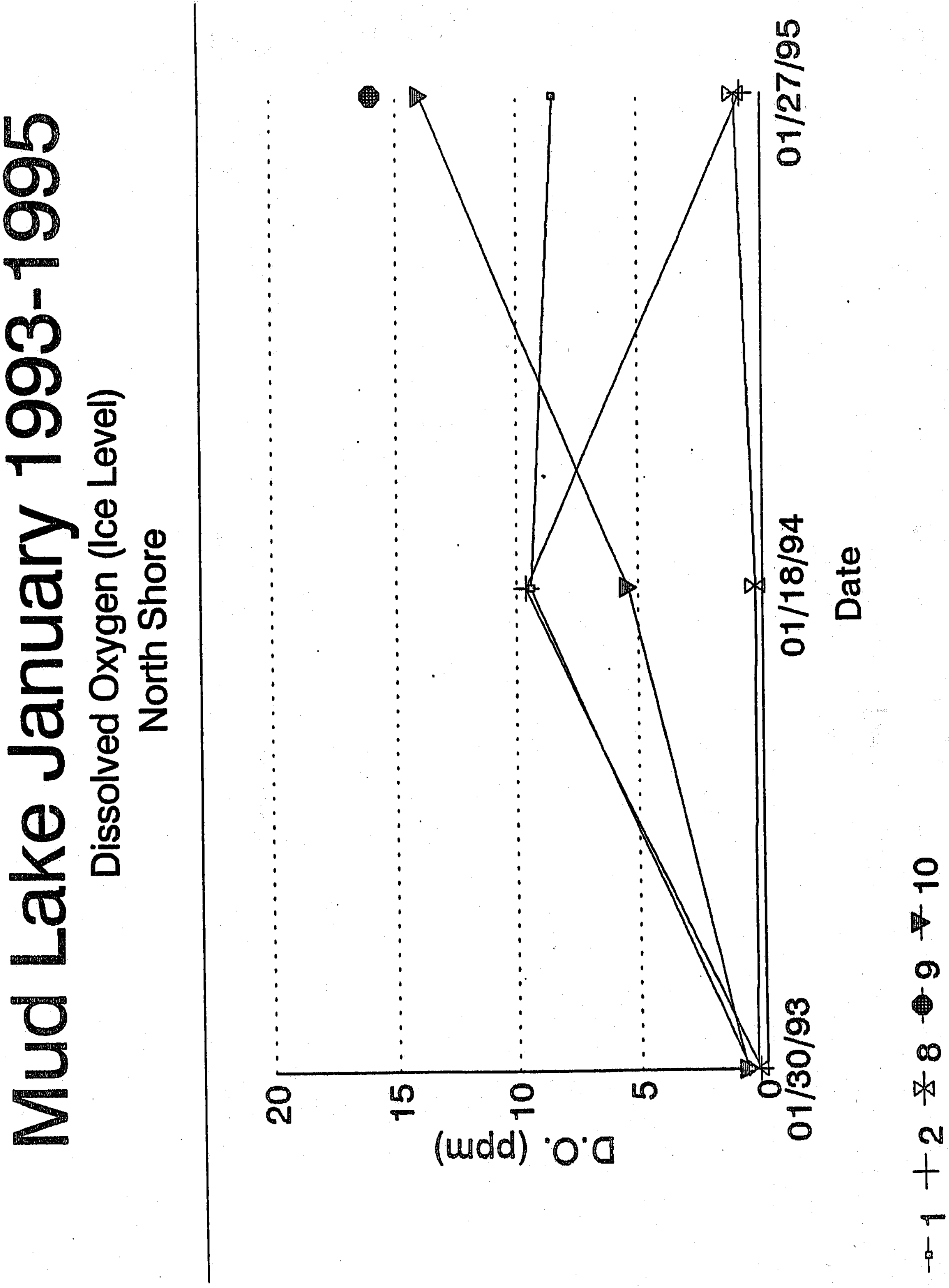




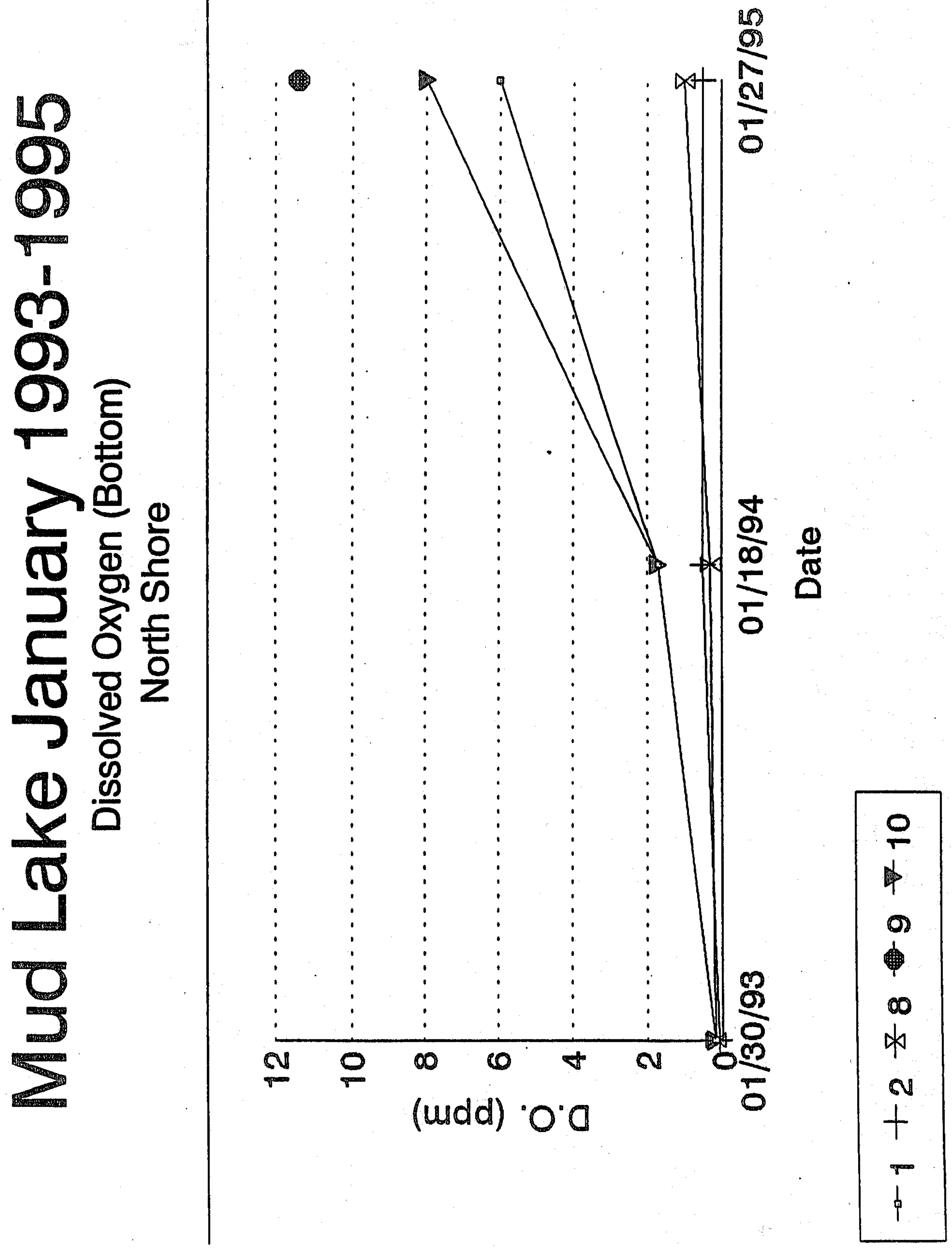
Mud Lake 02/24/95
D.O. Levels
Loon Bay Due South to Shoreline
D.O. (pppm)
10
8
6
4
2
0
8
I
H
K
L
Site
Ice Level
Average
Bottom

Appendix F. Graphic summary of winter dissolved oxygen readings at Mud Lake standard measurement sites, 1993-1995.

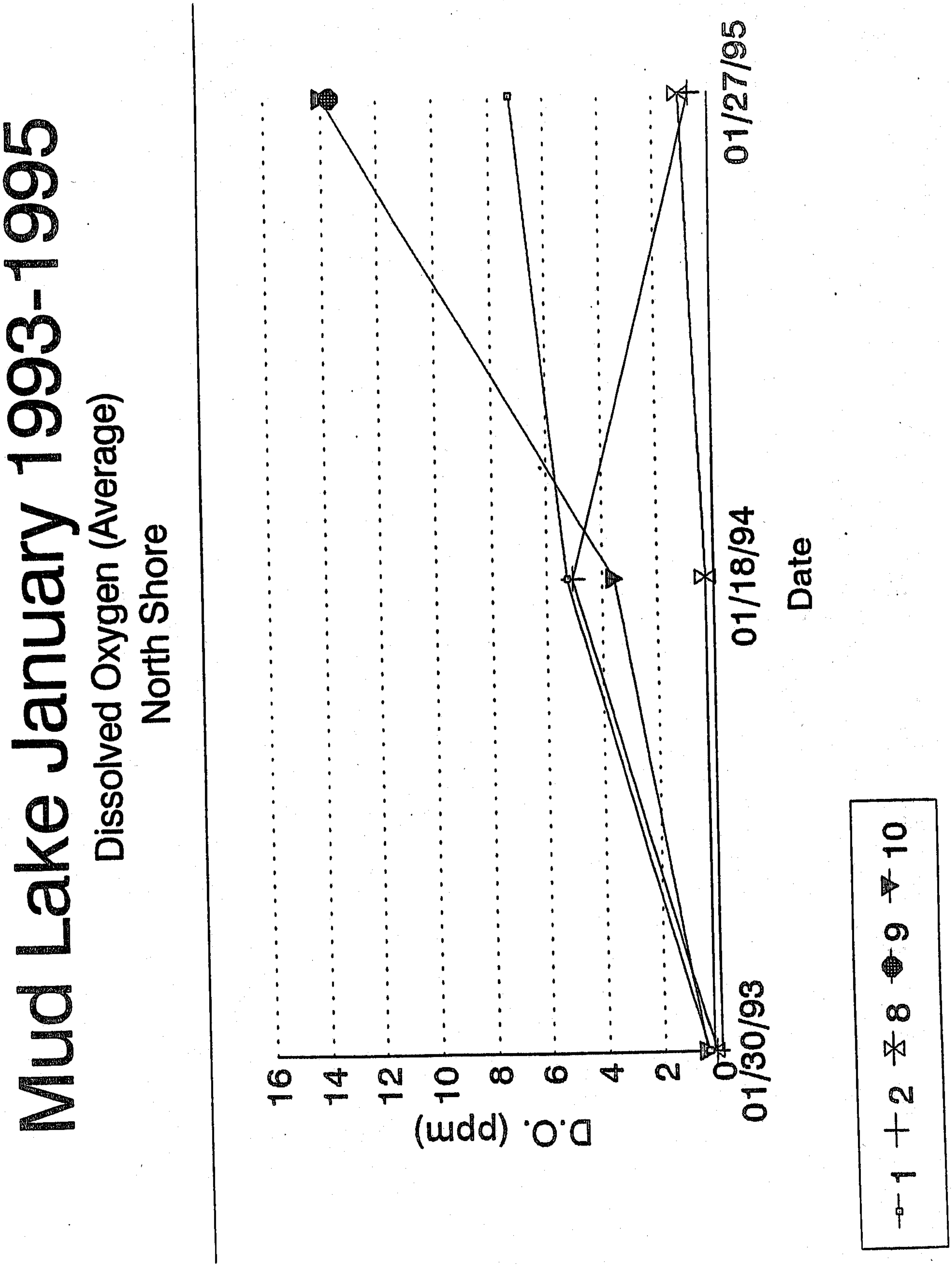
Appendix F. Continued.



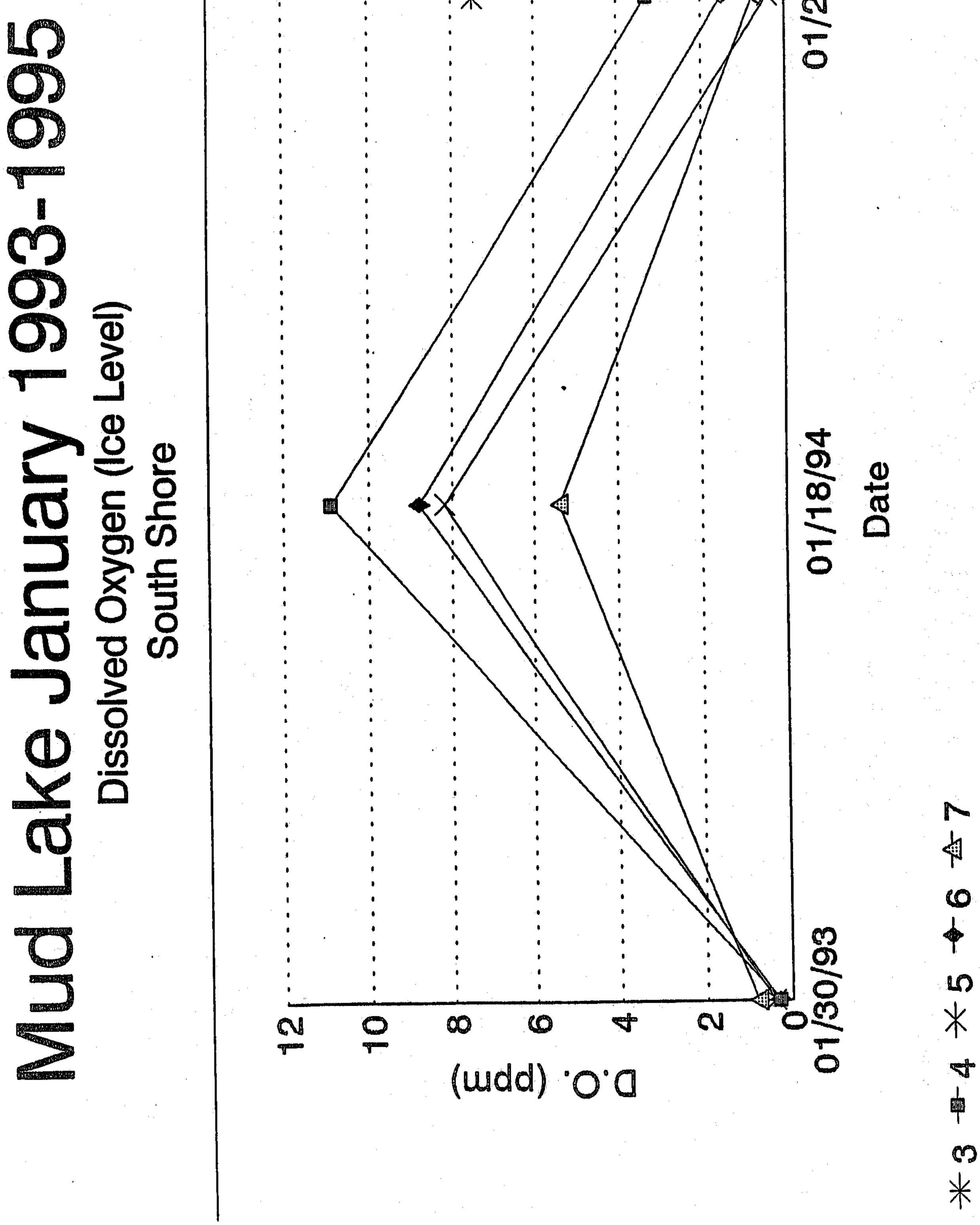
Appendix F. Continued.



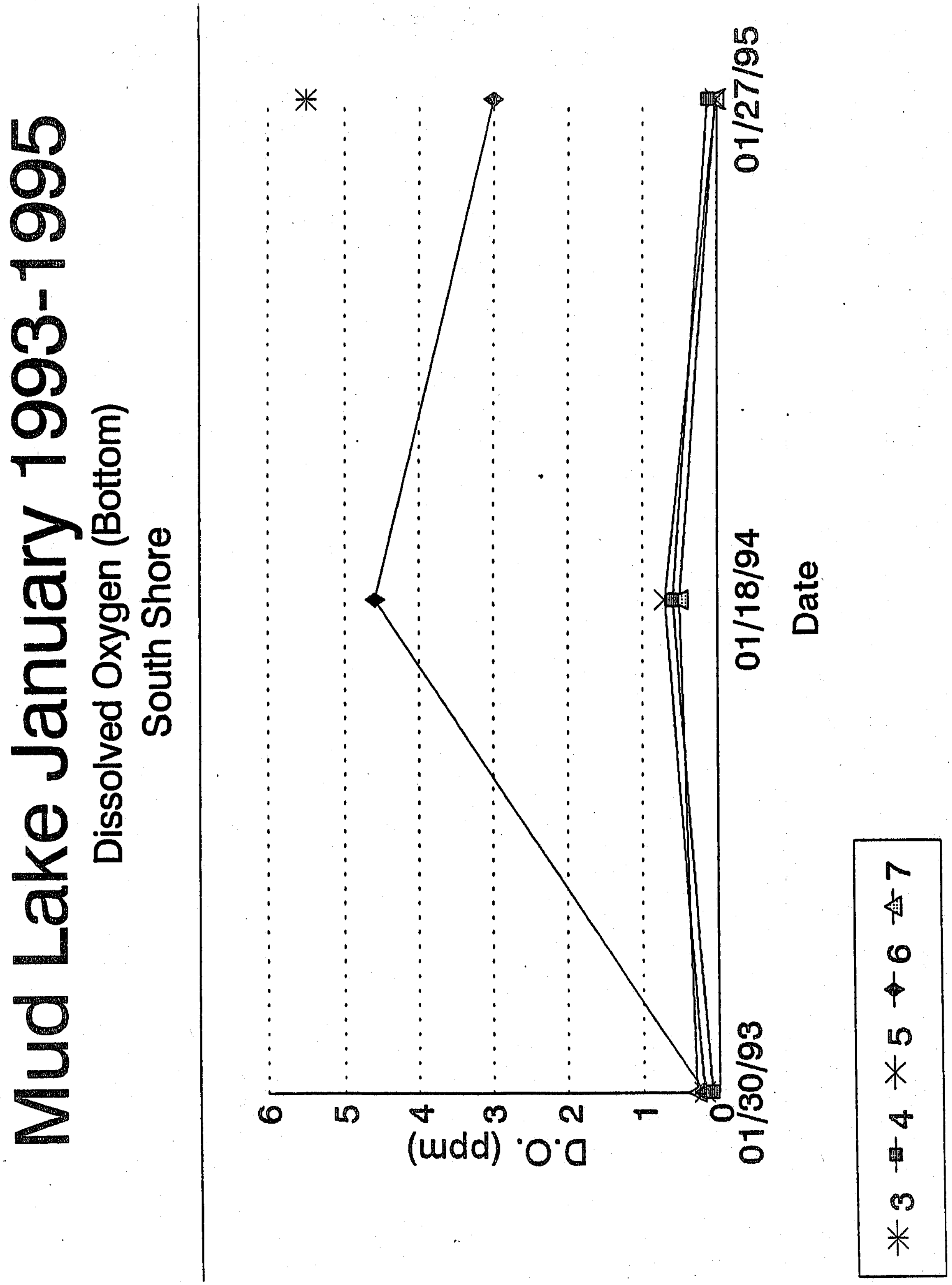
Appendix F. Continued.



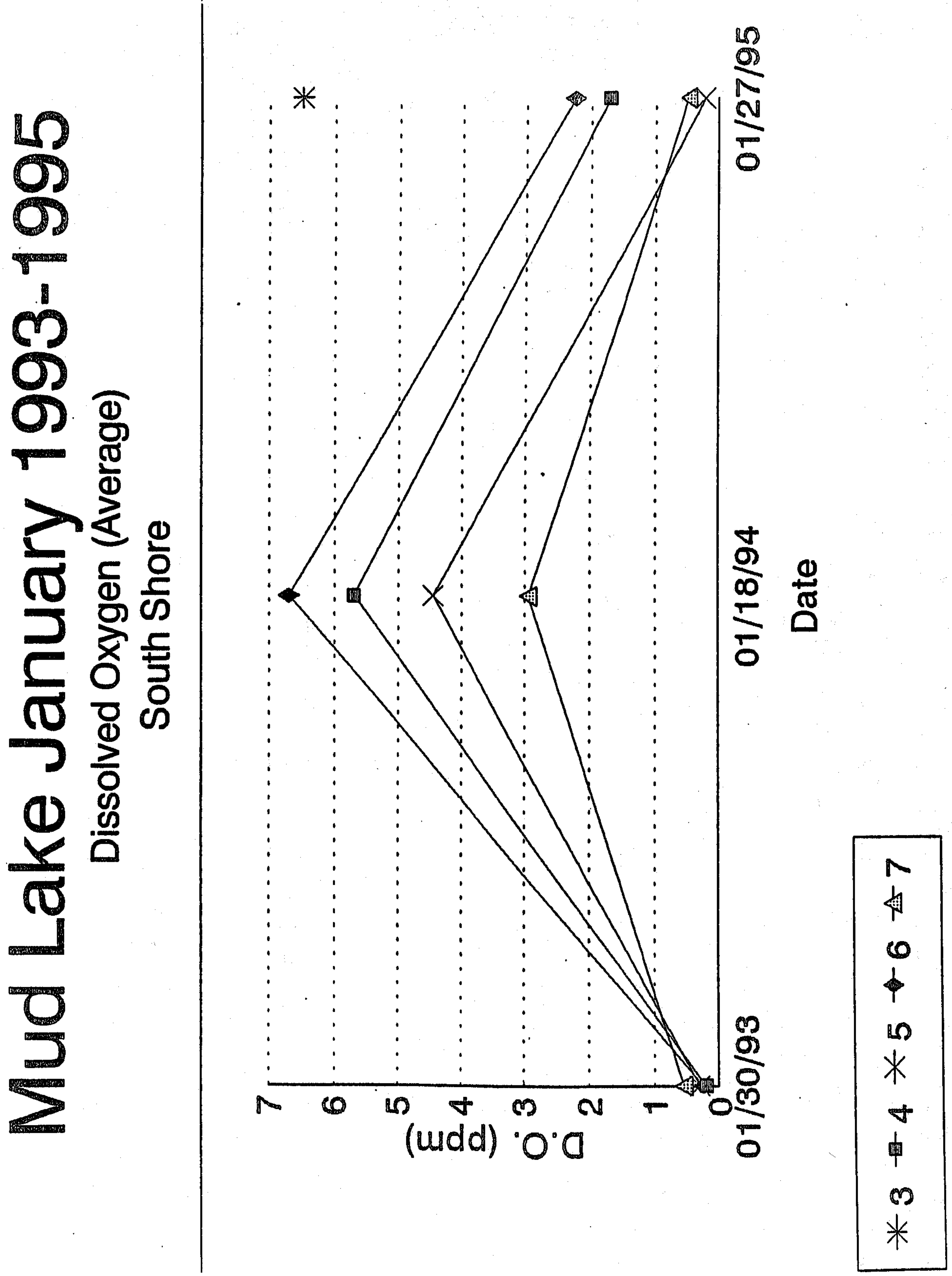
Appendix F. Continued.



Appendix F. Continued.



Appendix F. Continued.



Appendix G. Lowland lake survey results, Mud Lake, 1995.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
COVER SHEET

LAKE/RESERVOIR NAME: Mud Lake **REGION:** Upper Snake

DATE: 6/12/95 **SAMPLE CREW:** Travis Horton, Michael Quist

SCALE ENVELOPE NUMBERS: ________________ to __________________

SAMPLING CONDITIONS:

Water Temp. (^{o}C @ .5 m): 16 Air Temp. Range (^{o}C): _____ to

Secchi Range (m): _____ to

Wind (may circle more than one): 0-10 10-20 20+ mph

N NE E SE S SW W NW

SAMPLING EFFORT:

Combined floating and sinking gill net: 8 nights

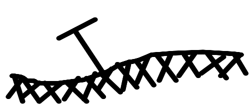
Electrofishing: 2 hours; trap net: 4 nights

Other (including add'l size selective sampling): ___________________________________

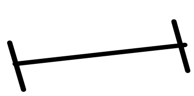
SAMPLING LOCATIONS:

Draw or attach a lake/reservoir map and indicate fisheries and limnological sampling locations; footnoting with narrative if necessary.

KEY:


Trap Net

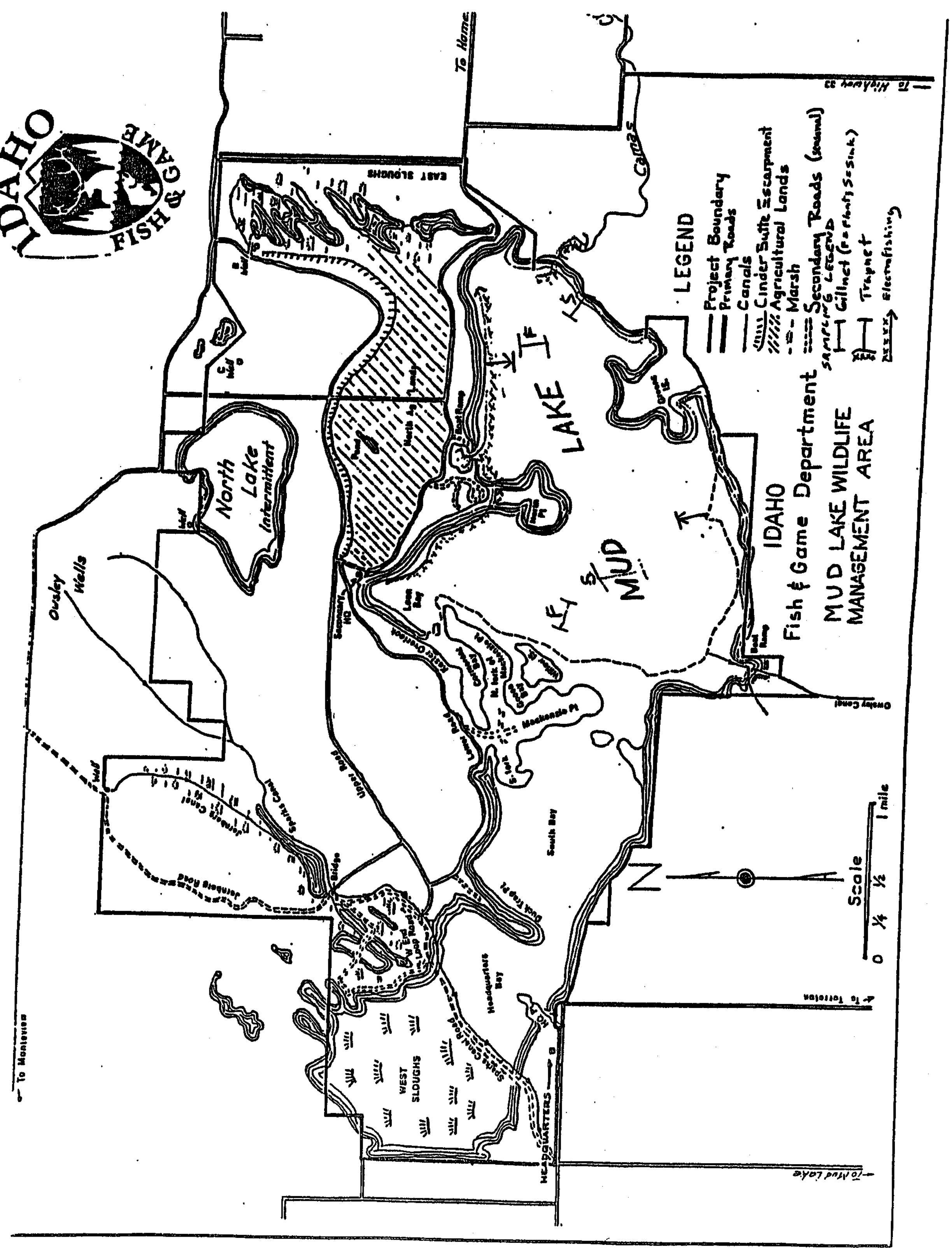
S-X Secchi reading


Gill Net (F,S,FS)

TDO-X Surface/bottom and profile readings


Electrofishing

Appendix G. Continued.



Appendix G. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (1 of 2)

LAKE/RESERVOIR NAME: Mud Lake REGION: Upper Snake
DATE: 6/13/95 SAMPLE CREW LEADER: B. Rich (Horton / Quist)

Length range	Species Utah chub				Species Utah sucker			
(mm)	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
> 350					11			
110-119								
120-129								
130-139								
140-149								
150-159					1			
160-169								
170-179								
180-189					1			
190-199								
200-209								
210-219								
220-229	1							
230-239	2							
240-249	2							
250-259	3				1			
260-269			1					
270-279								
280-289								
290-299								
300-309								
310-319								
320-329								
330-339								
340-349								
Batch Samples								
Size Range								
Numbers	8		1		14			
Total Weight								

Appendix G. Continued.

LOWLAND LAKES AND RESERVOIRS FISH SURVEY
DATA SHEET (2 of 2)

LAKE/RESERVOIR NAME: Mud Lake REGION: Upper Snake
DATE: 6/13/95 SAMPLE CREW LEADER: B. Rich (Horton / Quist)

Length range	Species yellow perch				Species largemouth bass			
(mm)	G.N.	T.N.	E.F.	Add'l	G.N.	T.N.	E.F.	Add'l
< 79			42					
80-89	1		40					
90-99	4		24					
100-109	1		10					
110-119			3					
120-129	1		1					
130-139	1					1		
140-149			1					
150-159			1					
160-169	1	3	2					
170-179	4	1						
180-189	2		1					
190-199								
200-209								
210-219	1							
220-229								
230-239	1							
240-249								
250-259								
260-269								
270-279								
280-289								
290-299								
300-309								
310-319								
320-329								
330-339								
340-349								
Batch Samples								
Size Range								
Numbers	17	4	125			1		
Total Weight								

1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-20

Project I: Surveys and Inventories

Subproject I-G: Upper Snake Region

Job: c[1]

Title: Rivers and Streams Investigations-South Fork Snake River

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

In the South Fork Snake River Palisades section, a total of 1,303 new trout were captured during four days of electrofishing in September 1995. Trout species composition and relative abundance were wild and hatchery cutthroat trout *Oncorhynchus clarki bouvieri* (60%), wild rainbow and hybrid trout *O. mykiss* (33%), wild brown trout *Salmo trutta* (7%), lake trout *Salvelinus namaycush* (<1%), and kokanee salmon *O. nerka kennerlyi* (<1%). A total of 1,635 new trout were captured during four days of electrofishing in the Conant section in October 1995. Trout species composition and relative abundance were wild and hatchery cutthroat trout (69%), wild rainbow and hybrid trout (16%), and wild brown trout (16%).

Brown trout relative abundance in the Palisades section has varied from 4% to 31% since 1987, the first year of electrofishing. Relative abundance in the Conant section has varied from 7% to 19% since 1982, the first year of electrofishing. There is no apparent trend at either section.

Cutthroat trout relative abundance in the Palisades and Conant sections was at an all-time low in 1995. In contrast, rainbow and hybrid trout relative abundance was at its highest at both sections. We consider these continuing trends a serious threat to the genetic integrity and long-term viability of wild cutthroat trout populations in the South Fork Snake River.

In the Palisades section, average fish length was 315 mm (12.4 in) for wild and hatchery cutthroat trout, 262 mm (10.3 in) for rainbow and hybrid trout, 279 mm (11.0 in) for brown trout and 295 mm (11.6 in) for all species combined. Quality Stock Density (QSD) was 30.7% for wild and hatchery cutthroat trout, 14.0% for rainbow and hybrid trout, 4.6% for brown trout, and 23.6% for all species combined. Our QSD management goal of 20% has been met for cutthroat trout and all species combined.

In the Conant section, average fish length was 351 mm (13.8 in) for wild and hatchery cutthroat trout, 277 mm (10.9 in) for rainbow and hybrid trout, 287 mm (11.3 in) for brown trout, and 328 mm (12.9 in) for all species combined. QSD was 21.2% for wild and hatchery cutthroat trout, 10.6% for rainbow and hybrid trout, 15.8% for brown trout, and 18.7% for all species combined. Our QSD management goal of 20% has been met for cutthroat trout but not for all species combined.

For all species combined in the Palisades section, estimated density of age 1 and older fish was 90 fish/ha for wild and hatchery cutthroat trout, 85 fish/ha for rainbow and hybrid trout, 7 fish/ha for brown trout, and 169 fish/ha for all species combined. Density is at an all-time high for each species and for all species combined, probably reflecting benefits of screening a major irrigation diversion in Palisades Creek in 1994.

In the Conant section, estimated density of age 1 and older fish was 172 fish/ha for wild and hatchery cutthroat trout, 38 fish/ha for rainbow and hybrid trout, 41 fish/ha for brown trout, and 239 fish/ha for all species combined. Unlike Palisades, density of cutthroat trout is at its lowest since 1986, but higher than the 1982 estimate prior to special regulations. Density of rainbow and hybrid trout is at an all-time high. Brown trout density is in the range of past years.

For each species, cross-sectioned otoliths provided a greater range of ages compared to using scales or surface-read otoliths. We aged cutthroat trout to 9+, rainbow and hybrid trout to 7+, and brown trout to 5+ using cross-sectioned otoliths, compared to 4+, 5+, and 4+ using scales, and 5+, 4+, and 3+ using surface-read otoliths, respectively. Over all species, two-thirds (66%) of paired samples of scales and surface-read otoliths agreed to age; fewer (59%) of paired samples of scales and cross-sectioned otoliths agreed to age.

Species identification in the field (based on morphology) did not match identification in the lab (based on genetics) for 23% of the sample (n=60). However, most identification error was between rainbow and hybrid trout, which we eventually grouped, and did not significantly affect the population trends we describe. Lab data also confirms that hybridization is occurring in the South Fork Snake River and that hybrids are fertile.

Presence of the whirling disease parasite *Myxobolus cerebralis* was confirmed positive for rainbow trout collected at the Palisades section in 1995. Lab results were presumptive positive for hybrid and cutthroat trout but negative for mountain whitefish *Prosopium williamsoni* and brown trout.

Wild cutthroat trout fry (208) were captured moving downstream in Rainey Creek, a tributary of the South Fork Snake River, from mid-September to early October 1995. Fewer yearlings (8) and no adults were captured. Timing, sizes, and relative numbers outmigrating were similar to 1994.

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Mark Gamblin
Regional Fishery Manager

INTRODUCTION AND STUDY SITE

Wild trout populations in the mainstem South Fork Snake River are monitored annually using electrofishing (all species) and an aerial count of redds (brown trout *Salmo trutta*). Four river sections have been electrofished in various years since 1986 (Figure 1): Palisades (5.0 km), Conant (4.9 km), Twin Bridges (2.9 km), and Lorenzo (4.8 km). However, only the Conant section has been sampled every year; a portion of this section was sampled in 1982 as well (Moore and Schill 1984). Brown trout redds have been counted since 1979. The last major creel census was conducted in 1982 (Moore and Schill 1984).

In the mainstem, special regulations restricting harvest of cutthroat trout were enacted upstream of the Heise measuring cable to Irwin in 1984 and extended to Palisades Dam in 1988 (Table 1). Based on this success, the Upper Snake River restricted cutthroat trout *Oncorhynchus clarki bouvieri* harvest regulation was implemented throughout eastern Idaho in 1990 and included the lower South Fork Snake River (below Heise) and all South Fork Snake River tributaries. The two fish, none between 8-16 inches, regulation was extended to all trout species in the mainstem (but not tributaries) in 1992. The lower river (below the Heise cable) is open year-round to fishing, whereas the upper river is closed December 1 to Memorial Day weekend (Figure 1).

Several additional tasks were either continued from past years or initiated in 1995. We continued building a database for mainstem electrofishing data using a computer program developed by Montana Department of Fish, Wildlife, and Parks (MARKRECAPTURE 4.0 [MR4]; MDFWP 1994). Our primary purpose is to simplify and standardize analysis; prior data storage and analysis were cumbersome and not standardized (Elle et al. 1987; Corsi and Elle 1989; Elle and Corsi 1994; Corsi and Elle 1994; Elle and Gamblin 1993; Gamblin et al. 1993). Most of the data collected since 1986, representing some 30,000 fish handled, have now been entered and checked (Table 2). We began the process in 1994 and expect to finish in 1996. This year we begin analyzing data for Palisades and Conant sections for significant trends.

Neither biomass nor standing crops have been estimated in the past (Elle et al. 1987; Corsi and Elle 1989; Elle and Corsi 1994; Corsi and Elle 1994; Elle and Gamblin 1993; Gamblin et al. 1993). These estimates are useful when monitoring wild trout populations, especially when combined with abundance or density estimates. For example, densities might be decreasing whereas average fish size and standing crops might actually be increasing. Difficulties deriving biomass and standing crop estimates are resolved using the MR4 computer program. However, weights of individual fish have not been measured in the past. Beginning in 1994 and continuing in 1995, subsamples of fish have been weighed to develop length-weight regressions. These regressions for each wild trout species (cutthroat, rainbow *O. mykiss* and hybrid, and brown) will be developed, tested for significant spatial (between electrofishing sections) and temporal (between years) differences, and reported in 1996. Final regressions will ultimately be used to predict fish weights from measured lengths, and to estimate historic and future biomass and standing crops.

Population age structures and year class strengths have been estimated in the past, but ages were based solely on visual inspection of length frequency distributions (Elle et al. 1987; Corsi and Elle 1989; Elle and Corsi 1994; Corsi and Elle 1994; Elle and Gamblin 1993; Gamblin et al. 1993). Ages have not been validated with known-age fish or with bony parts (scales or otoliths). Estimated population age structures are useful when monitoring wild trout populations by providing catch curves and total mortality rates. Estimated year class strengths are useful in correlating trends with environmental perturbations, such as low streamflows. Difficulties deriving these age-based estimates are resolved using the MR4 computer program but require some ages of individual fish. Beginning in 1993 and continuing

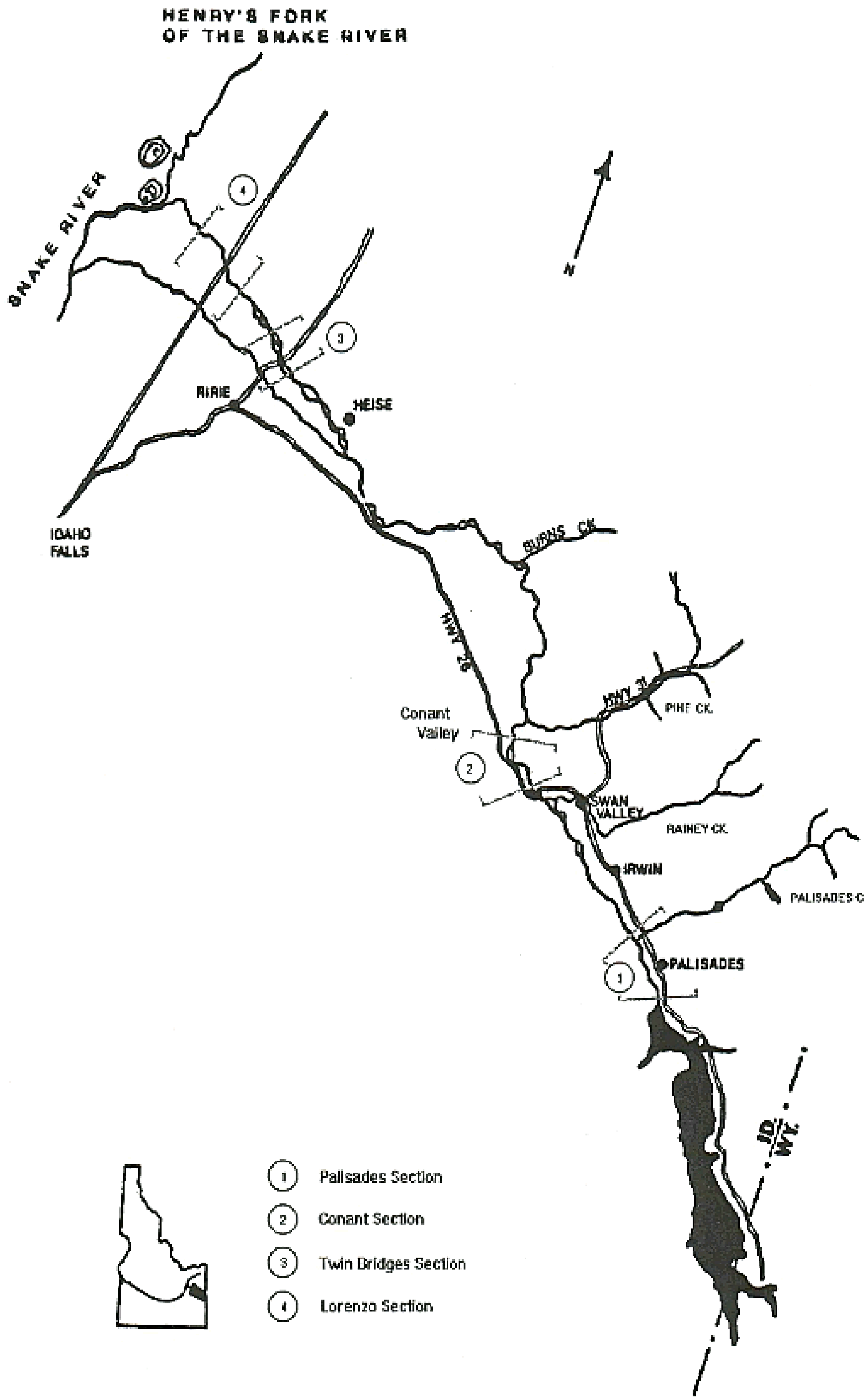

Figure 1. Map of South Fork Snake River showing electrofishing sections.

Table 1. Mainstem South Fork Snake River fishing regulations, 1970-1997.

Year	Season	Trout bag/size limit	Special
1970	May 30 - Nov 30	7 lb. + 1 fish, not to exceed 15 fish	Whitefish *Prosopium williamsoni* open 3/1 to 4/30 Irwin to Dam; Mouth to Heise cable open all year
1971	May 29 - Nov 30	7 lb. + 1 fish, not to exceed 15 fish	Whitefish open 3/1 to 4/30 Irwin to Dam; Mouth to Heise cable open all year
1972	May 27 - Nov 30	7 lb. + 1 fish, not to exceed 10 fish	Whitefish open 3/1 to 4/30 Irwin to Dam; Mouth to Heise cable open all year
1973	May 26 - Nov 30	7 lb. + 1 fish, not to exceed 10 fish	All species open 3/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1974	May 25 - Nov 30	10 fish, not more than 2 exceeding 14”	All species open 3/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1975	May 24 - Nov 30	10 fish, not more than 2 exceeding 14”	All species open 3/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1976	May 29 - Nov 30	10 fish, not more than 5 exceeding 12”, and not more than 2 exceeding 18”	All species open 3/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1977	May 28 - Nov 30	6 fish, only 2 over 16”	Same, except dam tailrace closed
1978	May 27 - Nov 30	6 fish, only 2 over 16”	Dam tailrace closed; all species open 5/27 to 9/30 Irwin to Dam; Mouth to Heise cable open 5/27 to 12/31
1979	May 26 - Nov 30	6 fish, only 2 over 16”	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1980	May 24 - Nov 30	6 fish, only 2 over 16”	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1981	May 23 - Nov 30	6 fish, only 2 over 16”	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year
1982	May 29 - Nov 30	6 fish, only 2 over 16”	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year, except open 9/1 to 11/30 within 100 yards of Burns Creek
1983	May 28 - Nov 30	6 fish, only 2 over 16”	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year, except open 9/1 to 11/30 within 100 yards of Burns Creek

Table 1. Continued.

Year	Season	Trout bag/size limit	Special
1984	May 26 - Nov 30	6 fish, only 2 over 16”, except Heise cable to Irwin only 2 CT, none between 10-16”, barbless hooks	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year, except open 9/1 to 11/30 within 100 yards of Burns Creek
1985	May 25 - Nov 30	6 fish, only 2 over 16”, except added hybrids	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year, except open 9/1 to 11/30 within 100 yards of Burns Creek
1986-1987	May 24/23-Nov 30	6 fish, only 2 over 16”, except added hybrids	Dam tailrace closed; all species open 4/1 to 9/30 Irwin to Dam; Mouth to Heise cable open all year, except open 9/1 to 11/30 within 100 yards of Burns Creek
1988-1989	May 28/27-Nov 30	6 fish, only 2 over 16”; except Heise cable to Dam only 2 CT or HYB, none between 10-16”	Mouth to Heise cable open all year; open 9/1 - 11/30 within 100 yards of Burns Creek
1990-1991	May 26/25-Nov 30	6 fish (except only 2 CT or HYB, none between 8-16”, on all rivers and streams)	Mouth to Heise cable open all year
1992-1993	May 23/29-Nov 30	2 fish, none between 8-16”	Mouth to Heise cable open all year
1994-1995	May 28/27-Nov 30	2 fish, none between 8-16”	Mouth to Heise cable open all year
1996-1997	May 25/24-Nov 30	2 fish, none between 8-16”	Mouth to Heise cable open all year

Table 2. Summary of electrofishing data from the South Fork Snake River that have been entered and checked using the computer program MR4.

Section/year	Entered	Checked
Lorenzo		
1987	X	
1988	X	
1989	X	
1990	X	
1991	X	
1993	X	
1995	X	X
Twin Bridges		
1989	X	
1991	X	
Dry Canyon		
1991		
Conant		
1986	X	X
1987	X	X
1988	X	X
1989	X	X
1990	X	X
1991	X	X
1992	X	X
1993	X	X
1994	X	X
1995	X	X
Palisades		
1987	X	X
1989	X	X
1991	X	X
1994	X	X
1995	X	

through 1995, subsamples of fish scales have been collected to develop age-length keys (Table 3). These keys for each wild trout species (cutthroat, rainbow/hybrid, and brown) will be developed, tested for significant spatial (between electrofishing sections) and temporal (between years) differences, and reported next year. Final keys will ultimately be used to predict fish ages from measured lengths and to estimate the above-population parameters, both historical and future.

Table 3. Number of trout scale samples collected, pressed, and archived from electrofishing sections in the South Fork Snake River, September to October, 1993-1995.

Section/Year	WCT/HCT[a]	WRB[a]	HYB[a]	BRN[a]	Total
Lorenzo					
1993	185	0	14	300	499
1994	--[b]	--	--	--	--
1995	268	0	8	450	726
					1,225
Conant					
1993	309	19	86	140	554
1994	296	48	54	111	509
1995	355	128	131	179	793
					1,856
Palisades					
1993	--[b]	--	--	--	--
1994	328	85	113	44	570
1995	407	163	200	84	854
					1,424
Grand Total	2,148	443	606	1,308	4,505

[a] WCT=wild cutthroat trout; HCT=hatchery cutthroat trout; WRB=wild rainbow trout; HYB=wild rainbow x cutthroat hybrid trout; BRN=wild brown trout.

[b] Not electrofished.

We assumed fish scales could be used to accurately age individual fish. Preliminary aging of scales from what appeared to be age 0 and 1 fish (by length frequency distributions) indicated that further validation was needed. We began a new task in 1995 to sacrifice fish for combined purposes: scales and otoliths (for age corroboration); liver, eye, and muscle tissue (for electrophoresis); and whole heads (for whirling disease). We also have otoliths from a few incidental mortalities during 1993 and 1994 electrofishing. Otoliths are generally considered more reliable than fish scales for accurately aging fish but require killing the individual. This year we report results of our efforts to corroborate fish age as assigned by scales, by sagittal otoliths (both surface and cross-section read), and by length frequency distributions for samples collected in 1995. Next year we will report the same for samples collected in 1993 and 1994. We will also report back-calculated lengths at age and annual increments of growth.

As mentioned, we sacrificed fish in 1995 for additional reasons besides age corroboration (electrophoresis and whirling disease). We have documented increasing numbers of rainbow and hybrid trout and are concerned about maintaining the genetic integrity and population viability of cutthroat trout in the South Fork Snake River. These trends are based on field identification of each species and their hybrids, which may not have been accurate or consistent in the past. Past identification has relied on morphological attributes (cutthroat slash combined with body coloration, spotting pattern, head shape) and not on meristic (counts), morphometric (measurements), or genetic (DNA or protein) characteristics. This year we addressed two basic questions: 1) Does species identification in the field based on morphology match identification in the lab based on genetics; if not, does that significantly affect the population trends we have observed? 2) Is hybridization occurring and, if so, are hybrids sterile?

We did not attempt to estimate current levels of genetic introgression by rainbow trout. Further, we did not address what levels of introgression (how pure) will cause reduced levels of cutthroat trout fitness or performance (Leary et al. 1995). This information is needed to provide a baseline for monitoring, to identify the best sites for protection and broodstock collection, and to identify population strongholds. We also did not attempt to distinguish finespotted cutthroat trout *O. clarki spp.* (an undescribed subspecies; Behnke 1992) from Yellowstone cutthroat trout as diagnostic loci have not been located (Rob Leary, personal communication).

As part of a statewide fisheries research project, we sacrificed fish in 1995 to test for whirling disease throughout the South Fork Snake River.

We continued monitoring juvenile cutthroat trout outmigration from Rainey Creek in 1995. This continues work began last year, and background for the project is in the 1994 report.

OBJECTIVES

1. Monitor South Fork Snake River wild trout populations in the mainstem by electrofishing and redd counts. Enter 1995 electrofishing data into MR4 computer program for standardized database and analysis. Summarize trout species composition, relative abundance, size structure, average fish length, quality stock density, and density for selected electrofishing sections (Palisades and Conant), 1986 to 1995.

2. Determine feasibility of using bony parts (scales and otoliths) to accurately age individual fish. Corroborate trout age as assigned by scales with age as assigned by otoliths (surface and cross-section read). Further corroborate trout age as assigned by bony parts with age as assigned by length frequency distributions.

3. Ascertain degree of error identifying cutthroat, rainbow, and hybrid trout in the field using protein gel electrophoresis in the lab. Also determine if hybridization is occurring and if hybrids are sterile.

4. Sample for presence of the whirling disease parasite in salmonid populations.

5. Monitor juvenile cutthroat trout outmigration from Rainey Creek in late summer and early fall; estimate timing, sizes, and ages of juveniles outmigrating.

METHODS

Mainstem Electrofishing

During 1995 we electrofished the Palisades section on September 19, 20, 28, and 29; the Conant section on October 5, 6, 12, and 13; and the Lorenzo section on October 2, 4, 10, and 11 (Figure 1; Appendix A). Two marking run days at each section were followed by two recapture run days about a week later. We had difficulty running the jet boat in the Lorenzo section on October 10 and 11 due to low flows (994 and 961 cfs, respectively); sampling should be conducted at higher flows in the future. The Twin Bridges section was not sampled in 1995 due to inaccessibility. As in 1994, the Palisades section was shortened to 5.0 km to avoid running a rapid just below Palisades Creek.

Fish were captured using direct-current (DC) electrofishing gear (Coffelt VVP-15 powered by a Honda 5000 W generator) mounted in an 18-foot Alumaweld sled with a 150 hp outboard jet. We used pulsed DC current through two boom-and-dangler anodes fixed to the bow while driving downstream. The boat hull was the cathode. VVP settings were at 225-300 V, 5-7 A, 20% pulse width, and 60 Hz (pulses per second). When we measured them, water temperatures varied from 11° to 14°C and conductivity varied from 200 to 420 umHOS/cm; flows varied from 961 to 7,300 cfs (at Lorenzo and Irwin gauges; USGS, provisional data; Appendix A). Though sections were not blocked at each end, we assumed fish would not move beyond natural habitat boundaries between marking and recapture runs.

We attempted to capture all species and sizes of trout; mountain whitefish and nongame fish were ignored. Fish were anesthetized with MS-222 (tricaine methane-sulfonate), identified, measured to the nearest millimeter (TL), and weighed to the nearest gram. Scale samples were taken near the caudal peduncle dorsal to the lateral line and ventral to the adipose fin. For each species at each section, we weighed and sampled scales on the first 10 fish captured per centimeter length group. Incidental fish mortalities were put on ice, frozen at the end of the day, and later dissected for otoliths. Other mortalities collected during recapture runs for age corroboration, electrophoresis, and whirling disease work will be described below. Brown trout less than 150 mm and all other species less than 100 mm (approximately age 0) were not marked; age 1 and older fish were marked with a caudal fin punch and then released.

Electrofishing data for 1995 were entered and analyzed using the computer program MARKRECAPTURE 4.0 (MR4; MDFWP 1994). We also used MR4 to analyze historical data (1986-1994) for selected electrofishing sections (Palisades and Conant). Other sections (Lorenzo, Twin Bridges, and Dry Canyon) will be analyzed and reported next year. All mainstem electrofishing data (except 1982; Moore and Schill 1984) is now stored in a standardized database and is available for standardized analysis. Previous data storage and analysis were not standardized (Elle et al. 1987; Corsi and Elle 1989; Elle and Corsi 1994; Corsi and Elle 1994; Elle and Gamblin 1993; Gamblin et al. 1993.

We assumed capture probabilities did not vary with species, and we estimated relative abundance using proportions of all new trout captured. Although capture probabilities vary with fish length (Schill 1992), population size structures (relative length frequency distributions), and average fish lengths were estimated using all sizes of new fish captured. Quality stock densities (QSD) were estimated using the number of new fish captured >16 inches divided by the number >8 inches, then times 100. Densities were estimated using two methods in the MR4 computer program; the log-likelihood method was preferred over the modified Peterson method if modeled efficiency curves were acceptable (termcode=1 and at least one of two chi-square p-values>0.05).

Brown Trout Redd Counts

The brown trout aerial redd count was not conducted in 1995 due to unavailability of aircraft.

Age Corroboration

Scale and Otolith Samples

We collected 326 paired samples of scales and sagittal otoliths in 1995 for age corroboration (Table 4). Most samples were from fish collected in the Palisades electrofishing section (183), followed by Conant (72) and Lorenzo (71). Most samples were also from fish we identified in the field as wild or hatchery cutthroat trout (98), followed by rainbow trout (86), hybrid trout (72), and brown trout (70). Electrophoresis work completed this year (see below) indicates we cannot accurately identify and separate rainbow from hybrid trout in the field. Paired samples from these two groups should be ultimately pooled for age corroboration analysis to give a larger sample size (158).

Of the 326 paired samples, most were collected in the Lorenzo (65) and Palisades (183) sections for whirling disease and were non-random (we emphasized collecting smaller and younger fish); the remainder in the Lorenzo section (6) were incidental mortalities and can be considered random (Table 4). Most samples collected in the Conant section (60) were for electrophoresis and were random; the remainder (12) were incidental mortalities and can be considered random. Hence, most (76%) of the paired samples were non-random, were not representative of the population, and cannot be used to construct catch curves or estimate total mortality rates (Ricker 1975).

Table 4. Number of trout paired otolith and scale samples collected, processed, and aged from electrofishing sections in the South Fork Snake River, September to October 1995.

Section	WCT/HCT[a]	WRB[a]	HYB[a]	BRN[a]	Total
Lorenzo	1	0	0	70	71
Conant	30	22	20	0	72
Palisades	67	64	52	0	183
Grand Total	98	86	72	70	326

[a] WCT = wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.

Fish were captured during standard electrofishing runs in the fall, put on ice or frozen, and returned to the lab. Each fish was then identified and measured to the nearest millimeter (TL). A scale sample was taken near the caudal peduncle dorsal to the lateral line and ventral to the adipose fin; scales were placed in a coin envelope and the appropriate data recorded (Appendix B). Both sagittal otoliths were excised using a quick and reliable technique described by Mackay et al. (1990) and Schneidervin and Hubert (1986). After removing the mucous membrane surrounding each otolith, we put the pair into a 3.7 ml vial containing a 50:50 mixture of glycerine and water (just enough to cover the otoliths); we also added several drops of ethanol to retard mold growth. The field vial was then closed with a numbered cap and placed into a species-specific field storage box. We later transferred the vial to a numbered archive box and replaced the vial cap with another uniquely numbered one. We found this transfer confusing and recommend using only the unique, consecutively numbered archive boxes, vials, and caps in the future. Both field and archive vial numbers and the archive box number were recorded in the electrofishing data book (if possible) and on the scale envelope for cross-referencing. We also transferred information from the scale envelope onto a Rite-in-the-Rain® label and placed it in the vial; this step is necessary in case the vial cap is lost or misplaced.

Fish had to be reidentified, remeasured, and resampled for scales in the lab because of the large numbers of similar-sized fish collected in the field. We tried excising otoliths in the field but found the process too time consuming. Further, otoliths stored in scale envelopes became brittle and prone to breaking.

Scale and Otolith Processing

Scale envelopes were sorted by year, electrofishing section, species, and fish total length. Twenty successive envelopes were then numbered to correspond to a preformatted gum card (Appendix B). Data recorded on each envelope was also transferred to an aging data sheet (Appendix B) that corresponded to the gum card. Scales were scraped from the envelopes and affixed to the gum card with water. The gum card was air dried and hot-pressed (to minimize scale distortion) into acetate sheets using a Carver Model C, 12-ton press at 175^{o}F and 20,000 lb for 1.5 minutes (Dery 1983). Acetate sheets were archived in the regional office for future reference and aging.

Otoliths were processed using methods described in Appendix B.

Scale and Otolith Aging

We used a Northwest Microfilm Model 385 microfiche projector at 48X magnification to read scale impressions on the acetate sheets. We followed guidelines described by Jearld (1983) to age the fish and recorded age on the aging data sheet (Appendix B). We also marked the focus, successive annuli, and the edge on a paper slip. Slips will be digitized into DISBCAL 89 (Frie 1982; Missouri Department of Conservation 1989) using a Summagraphics SummaSketch III digitizing pad at a later date for age and growth analysis.

Otoliths were aged independently using methods described in Appendix B and by Chilton and Beamish (1982). We aged the whole otolith, reading it from the surface (sulcus down), and we also aged a cross-section of one of the otoliths leaving the other for future reference. We did not cross-section an otolith if one of the pair was missing. Age was recorded on the aging data sheet (Appendix B).

To enter and analyze scale and otolith data (both surface and cross-section read) we used SYSTAT for corroboration. Paired samples will eventually be pooled by section and species, for each year of collection, and used to estimate mean back-calculated lengths at age and annual increments of growth. We will use DISBCAL 89 for this analysis.

Species Identification and Hybridization

Fish samples were collected in the Conant electrofishing section during standard recapture runs on October 12 and 13, 1995. To randomly sample 20 Yellowstone cutthroat trout, 20 rainbow trout, and 20 hybrid trout as identified in the field, we estimated beforehand how many fish of each species we might handle over the next two days of electrofishing. We selected random numbers from a table (Zar 1984) and marked data sheets accordingly. We limited our sample to wild fish >100 mm as smaller fish cannot be accurately identified in the field. When a fish's number came up while processing the catch, that individual was killed. To avoid bias, the person processing the catch did not know which fish was to be sampled. Standard processing of the electrofishing catch is described above.

Each whole fish was labeled by a unique number ranging from CON-1 to CON-60, photographed for later reference, and then put on ice. Liver, eye, and muscle tissue was excised within 24 h, placed in a non-sterile zip-lock bag, and frozen in an ordinary chest freezer. A sugar cube-sized piece of muscle tissue or larger was excised anterior to the dorsal fin and above the lateral line. Both sagittal otoliths were also removed and stored with a scale sample (see above). Sample bags were labeled with location (SFSR), date, and sample number (CON-1 to CON-60); however, species designations were not labeled. These blind samples were then shipped to the Wild Trout and Salmon Genetics Lab, University of Montana, for electrophoretic analysis. The smallest fish sampled was 173 mm, and the largest was 465 mm. Carcasses were frozen for later reference and were not used for whirling disease sampling.

Horizontal starch gel electrophoresis was used to determine each fish's genetic characteristics at 45 loci coding for proteins present in eye, liver, or muscle tissue (Appendix C). The protein products of six diagnostic loci are known to differentiate Yellowstone cutthroat trout from rainbow trout (Leary et al. 1987; Appendix C). In essence, the procedure determines at near certainty whether the fish came from a genetically pure population of Yellowstone cutthroat trout or rainbow trout, from pure parents of both species (F1 hybrid), or from at least one hybrid parent (F2 hybrid or backcross).

The total cost of the electrophoresis analysis was $1,650.00 or $27.50 per fish.

Whirling Disease

We sacrificed 383 fish in 1995 to test for the whirling disease parasite *Myxobolus cerebralis* (Table 5). Most fish were collected in the Palisades electrofishing section (243) followed by the Lorenzo section (140); no fish were collected in the Conant section for this purpose. At least 50 individuals of each game fish species (including mountain whitefish) were sampled. Electrophoresis work completed this year (see below) indicates we can not accurately identify and separate rainbow trout from hybrid trout in the field, and samples from these two groups should be pooled in the future. Samples were not random; we emphasized collecting younger and smaller fish (sub-yearlings <150 mm for fall spawners; yearlings 100-250 mm for spring spawners). All deformed fish encountered were also sampled.

Table 5. Number of trout and mountain whitefish whirling disease samples collected and processed from electrofishing sections in the South Fork Snake River, September to October 1995.

Section	WCT/HCT[a]	WRB[a]	HYB[a]	BRN[a]	MWF[a]	Total
Lorenzo	0	0	0	65	75	140
Conant	0	0	0	0	0	0
Palisades	67	70	53	0	53	243
Grand Total	67	70	53	65	128	383

[a] WCT = wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout; MWF = mountain whitefish.

Fish were captured during standard electrofishing runs in the fall, put on ice, and returned to the lab. Fish were processed within 24 h as described above for age corroboration work (except we did not take scale and otolith samples from mountain whitefish). To obtain brain, cranial tissue, and bone, whole heads were removed by cutting posterior to the pectoral fins. Five heads were placed in a non-sterile, quart-sized, zip-lock bag and frozen in an ordinary chest freezer. Bags were labeled with species, river, section, date, and individual lengths of fish. Samples and appropriate forms were then shipped to the IDFG Fish Health Lab (Eagle, Idaho) for testing. Carcasses were frozen for future electrofishing injury research.

Rainey Creek Fry Trapping

We operated a fry trap and several minnow traps in Rainey Creek from September 14 to October 1, 1995 to capture most fish moving downstream to the South Fork Snake River. We installed the traps with assistance from local Trout Unlimited volunteers and Targhee National Forest personnel. They were located at the proposed diversion/ladder site on the National Forest boundary (S34, T41N, R44E) about 7 miles above the confluence with the South Fork Snake River.

The fry trap consisted of one-quarter inch mesh hardware cloth leads extending from each stream bank to a fyke net attached to a holding box. The box was checked twice daily (morning and evening) by Idaho Department of Fish and Game (IDFG) personnel and Trout Unlimited (TU) volunteers until debris forced the removal of the trap in early October. Water temperatures were also recorded when checking the box.

After capture, fish were anesthetized with tricaine methane sulfonate (MS-222), identified, and measured to the nearest cm (TL). They were allowed to recover and then hauled to lower Rainey Creek near Swan Valley and released.

RESULTS AND DISCUSSION

Mainstem Electrofishing

Palisades Section

Trout Species Composition and Relative Abundance-A total of 1,303 new trout were captured during four days of electrofishing in September 1995. Trout species composition and relative abundance (Figure 2; Appendix A-1) were wild and hatchery cutthroat trout (60%), wild rainbow and hybrid trout (33%), wild brown trout (7%), lake trout *Salvelinus namaycush* (<1%), and kokanee salmon *O. nerka kennerlyi* (<1%). Hatchery cutthroat trout (finespotted), lake trout, and kokanee salmon are flushed from Palisades Reservoir; their numbers may be directly related to the extent of reservoir drawdown (Gamblin et al. 1993).

The proportion of brown trout captured by electrofishing has varied from 4% to 8% since 1989 and from 4% to 31% since 1987 (Appendix A-1). There is no apparent trend. The large proportion captured in spring 1987 may reflect holdover from spawning.

The proportion of wild and hatchery cutthroat trout captured by electrofishing is at an all-time low (60%) since electrofishing began in 1987 (Figure 2; Appendix A-1). In contrast, the proportion of rainbow and hybrid trout matches last year's all-time high (33%). We view the 1987 data with caution as sampling was conducted in March rather than September and the sample size was small (n=301). However, both trends are apparent even if we discount this year. We consider these trends a serious threat to the genetic integrity and long-term viability of wild cutthroat trout populations in the South Fork Snake River.

These trends presuppose accurate and consistent field identification of the two species and their hybrid. Based on genetics work done in 1995 (see below), we cannot distinguish pure rainbow trout from hybrid trout in the field. However, with a small margin of error, we can distinguish rainbow and hybrid trout as a group from pure cutthroat trout. We will group rainbow and hybrid trout for future analysis. As discussed below, the small margin of error distinguishing rainbow and hybrid trout from cutthroat trout does not significantly alter the disturbing population trends that we describe.

Means of accurately distinguishing cutthroat trout fry from rainbow and hybrid fry (<100 mm) still needs to be developed. However, our inability to separate them does not significantly alter the above trends due to the low numbers captured. We recommend continuing use of a variety of common morphological attributes (cutthroat slash combined with coloration, spotting pattern, and head shape) to identify age 1 and older fish.

We dismiss the possibility that numbers of hatchery cutthroat trout, or wild finespotted cutthroat trout, flushed from the reservoir have declined and are the cause of these trends. First, Palisades Reservoir was drawn down a record 98% in 1994, and we would expect an increase, not decrease, in reservoir cutthroat trout in the South Fork Snake River that year (Gamblin et al. 1993). Second, sample sizes were similar in 1989, 1991, and 1994 (about 1,000 fish), and absolute numbers of wild rainbow and hybrids captured increased from <100 to >300 (Appendix A-1). Wild rainbow and hybrid electrofishing efficiencies have also not increased but rather have decreased since 1989 (Appendix A-3), probably as average sizes of fish captured have declined (Appendix A-2). Palisades Reservoir is not stocked with

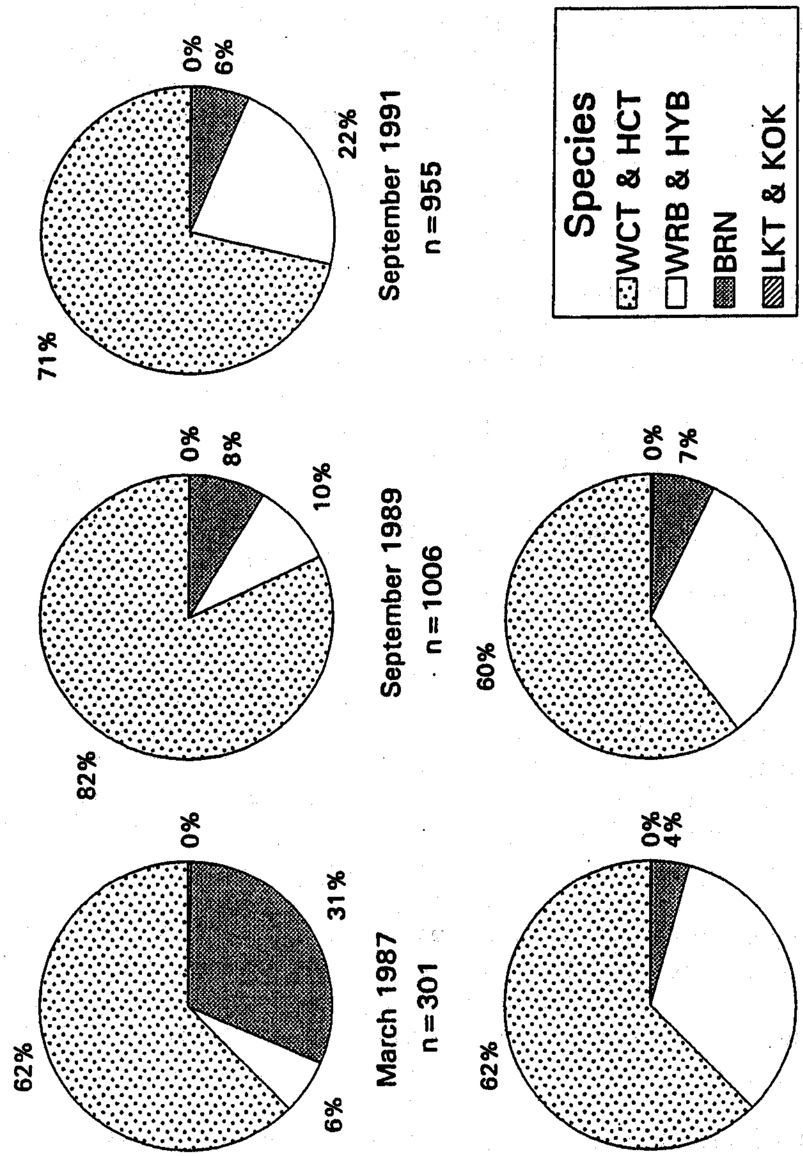

Figure 2. Trout species composition and relative abundance (%) at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

rainbow trout, a resident rainbow population does not exist, and flushing does not explain increasing numbers in the South Fork Snake River.

We believe hatchery finespotted cutthroat trout originating from the reservoir cannot be accurately distinguished from wild riverine cutthroat trout as previous authors have reported (Gamblin et al. 1993; Corsi and Elle 1989, 1994). We attempted, but abandoned, trying to distinguish them in 1994 and 1995 as hatchery fish identification was not possible (using eroded fins, spotting patterns, or marks). However, beginning in 1995, about half of the sub-catchables and all the catchables stocked were differentially marked with a pelvic fin clip. In 1996, all fish stocked into the reservoir will be clipped. We will attempt to estimate their contribution to the South Fork Snake River fishery in the future.

Size Structure, Average Length, and Quality Stock Density-Wild and hatchery cutthroat trout length frequency distributions for 1995 show good representation of what we believe are age 1 fish (152 to 254 mm) and age 3 and older fish (>356 mm; Figure 3). Likewise, strong groups of similar-sized age 1 rainbow and hybrid trout (Figure 4) and brown trout (Figure 5) are apparent. These strong year classes produced in 1994 and carried over to age 1 in 1995 may reflect benefits of screening a major irrigation diversion in Palisades Creek (on-line in spring 1994). If so, irrigation diversions may be more important than other factors limiting recruitment in the South Fork Snake River. We predicted few yearlings in 1995 because 1994 was a poor water year. Tributary incubating and rearing conditions during spring and summer were dismal. And minimum flows in the mainstem the following winter (1,204 cfs at Irwin) were below recommended levels (1,500 cfs; Schrader and Griswold 1994). We note that relatively low numbers of age 2 cutthroat trout (254 to 356 mm; Figure 3) in 1989, 1994, and 1995 may reflect poor summer or winter water conditions during their first year of life and when the screen was not operating.

Rainbow and hybrid trout (Figure 4) and brown trout (Figure 5) length frequency distributions for 1995 show relatively few age 2 and older fish. We cannot explain the relative decline in large fish of both species since 1989 and would have expected an increase after special regulations were implemented in 1992. We note, however, that rainbow and hybrids are increasing in this section while brown trout are stable.

Our results are confounded by our lack of age and growth data and, for cutthroat trout, our inability to distinguish wild from hatchery fish. This will be resolved for future monitoring.

For 1995, average fish length was 315 mm for wild and hatchery cutthroat trout (n=785), 262 mm for rainbow and hybrid trout (n=426), 279 mm for brown trout (n=88), and 295 mm for all species combined (n=1,303; Appendix A-2). Quality Stock Density was 30.7% for wild and hatchery cutthroat trout, 14.0% for rainbow and hybrid trout, 4.6% for brown trout, and 23.6% for all species combined. Our QSD management goal of 20% has been met for cutthroat trout and all species combined.

Density-For 1995, estimated density of age 1 and older fish was 90 fish/ha for wild and hatchery cutthroat trout (Appendix A-4); 85 fish/ha for rainbow and hybrid trout (Appendix A-5); 7 fish/ha for brown trout (Appendix A-6); and 169 fish/ha for all species combined (Appendix A-7). Age 1 and older fish were considered ≥102 mm (4 in) for cutthroat, rainbow, and hybrid trout, and ≥152 mm (6 in) for brown trout. These ages were corroborated using cross-sectioned otoliths and length frequency distributions. The calculated estimate for all species combined (169 fish/ha) is smaller than the summed estimates for all species (182 fish/ha).

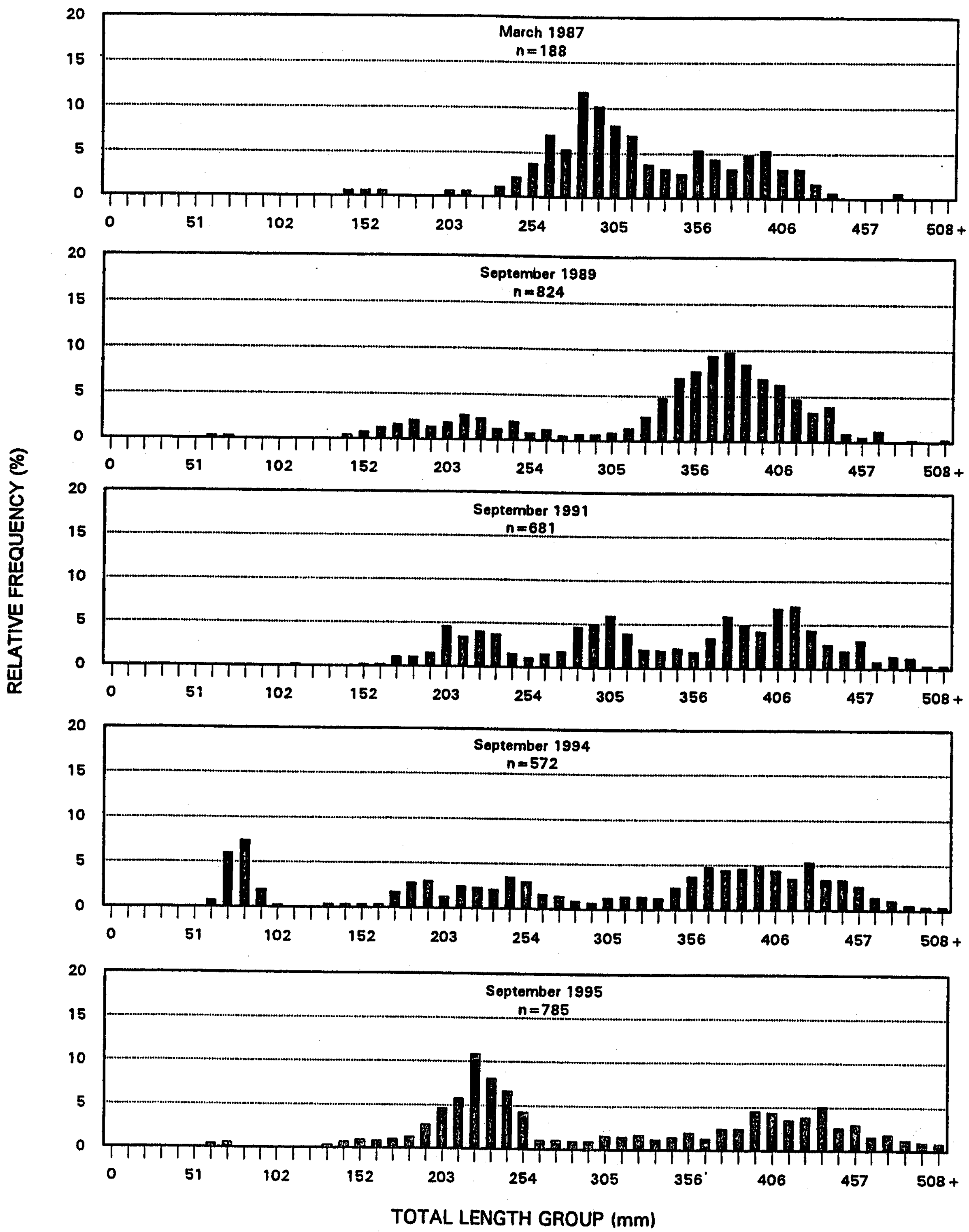

Figure 3. Relative length frequency distributions (%) of wild and hatchery cutthroat trout captured at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

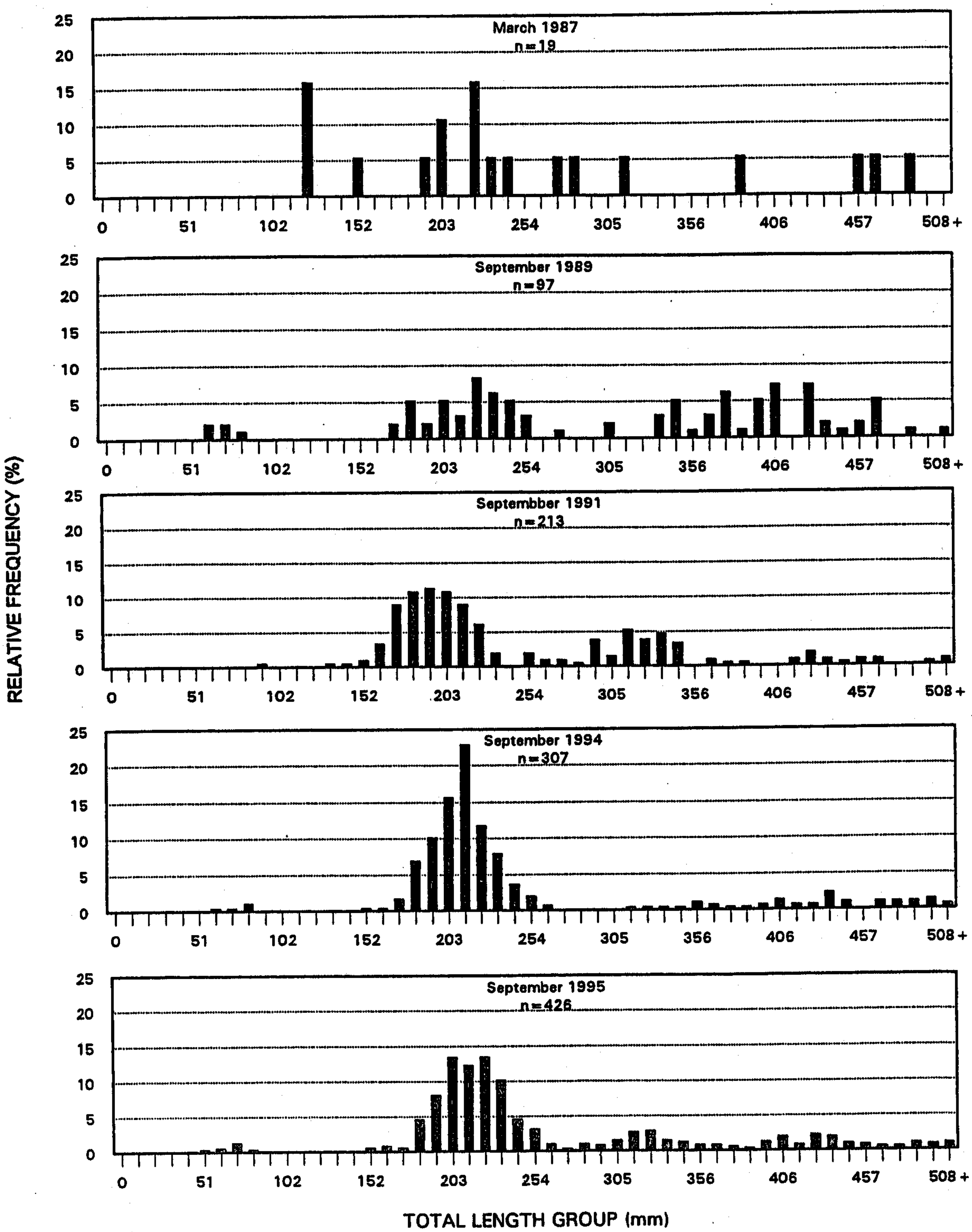

Figure 4. Relative length frequency distributions (%) of wild rainbow and hybrid trout captured at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

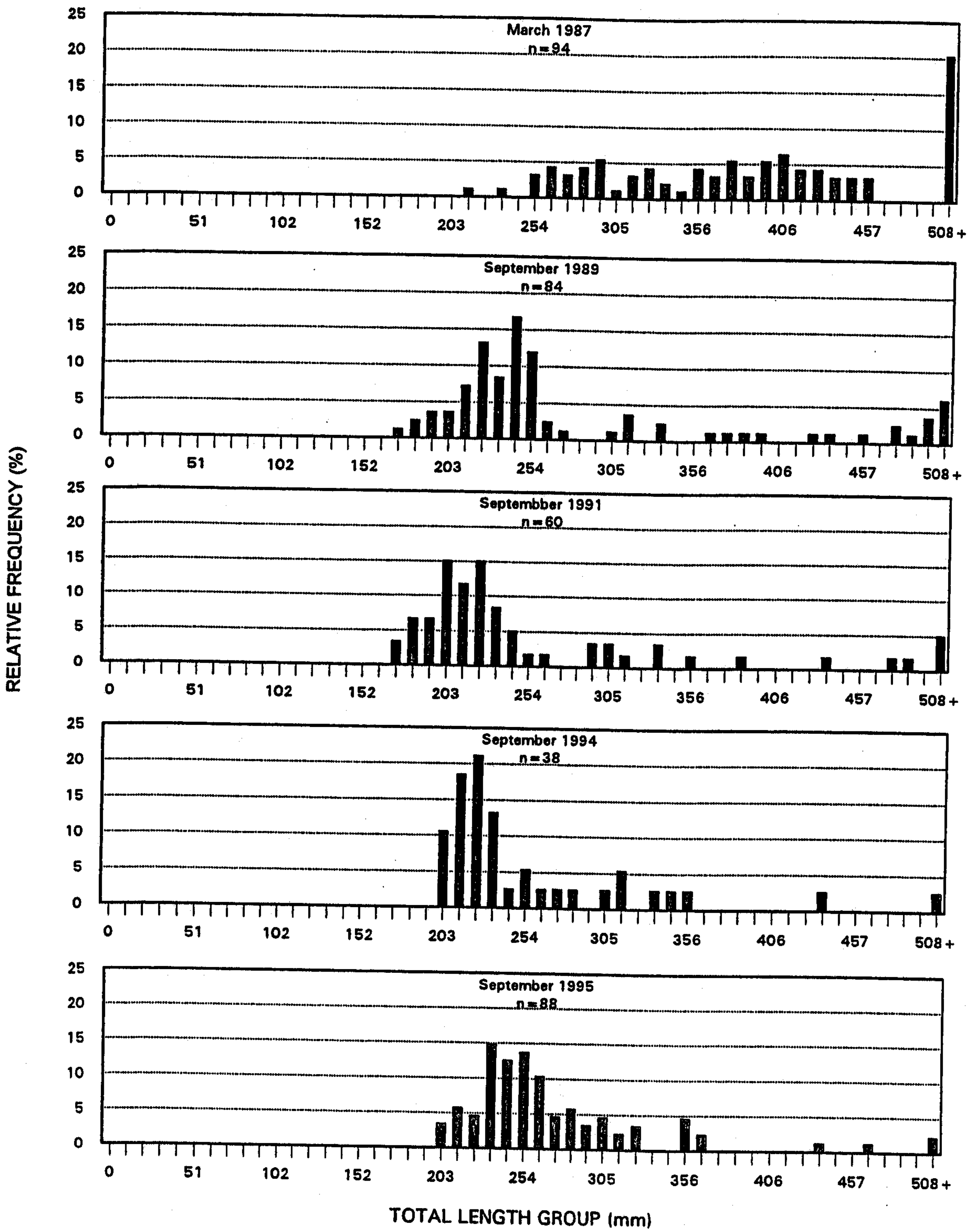

Figure 5. Relative length frequency distributions (%) of wild brown trout captured at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

Density is at an all-time high since 1987 for each species (Appendices A-4 to A-6) and for all species combined (Appendix A-7). As discussed above, this may reflect benefits of screening a major irrigation diversion in Palisades Creek (on-line in spring 1994).

Although cutthroat trout density is at a record high (matching the high 1989 estimate; Figure 6), relative abundance is at an all-time low (Figure 2). In contrast, rainbow and hybrid trout density (Figure 6) and relative abundance (Figure 2) are at unprecedented highs. We consider these trends a serious threat to the genetic integrity and long-term viability of wild cutthroat trout populations in the South Fork Snake River.

Conant Section

<u>Trout Species Composition and Relative Abundance</u>-A total of 1,635 new trout were captured during four days of electrofishing in October 1995. Trout species composition and relative abundance (Figure 7; Appendix A-8) were wild and hatchery cutthroat trout (69%), wild rainbow and hybrid trout (16%), and wild brown trout (16%). No lake trout or kokanee salmon were captured in 1995. Hatchery cutthroat trout (finespotted), lake trout, and kokanee salmon are flushed from Palisades Reservoir; their numbers may be directly related to the extent of reservoir drawdown (Gamblin et al. 1993).

The proportion of brown trout captured by electrofishing has varied from 7 to 19% since 1982 (Figure 7; Appendix A-8); there is no apparent trend.

The proportion of wild and hatchery cutthroat trout captured by electrofishing is at a record low (69%) since electrofishing began in 1982 (Figure 7; Appendix A-8). The proportion has declined 10% since last year and has declined 20% since the record high of 1989. In contrast the proportion of rainbow and hybrid trout is at an unprecedented high (16%), has increased 7% since last year, and has increased 15% since the record low of 1982. We view the 1982, 1986, and 1987 data with caution as sampling was conducted in November rather than October. Further, the section was shortened in 1982 and 1987, and sample sizes were small (n=229 and n=348, respectively). However, both trends are apparent even if we discount these years. We consider these trends a serious threat to the genetic integrity and long-term viability of wild cutthroat trout populations in the South Fork Snake River.

These trends presuppose accurate and consistent field identification of the two species and their hybrid. We discuss this assumption above for the Palisades section and discuss the genetic data collected in the Conant section below. Our comments relative to identifying fry and fish flushed from the reservoir are appropriate for the Conant section as well. We note that the Conant section is located further downstream than the Palisades section and is less influenced by fish flushed from the reservoir.

<u>Size Structure, Average Length, and Quality Stock Density</u>-Wild and hatchery cutthroat trout length frequency distributions for 1995 show poor representation of what we believe are age 1 fish (152 to 254 mm; Figure 8). In contrast, strong groups of similar-sized age 1 wild rainbow and hybrid trout (Figure 9) and brown trout (Figure 10) are apparent. Lack of cutthroat trout yearlings fit our predictions as described above for the Palisades section, but we cannot explain the strong year classes of rainbow, hybrid, and brown trout. We note that a graduate study on the life history of rainbow and hybrid trout in the South Fork Snake River will provide more information on their recruitment limitations.

Rainbow and hybrid trout (Figure 9) and brown trout (Figure 10) length frequency distributions for 1995 show relatively few age 2 and older fish. We cannot explain the relative decline in large fish of

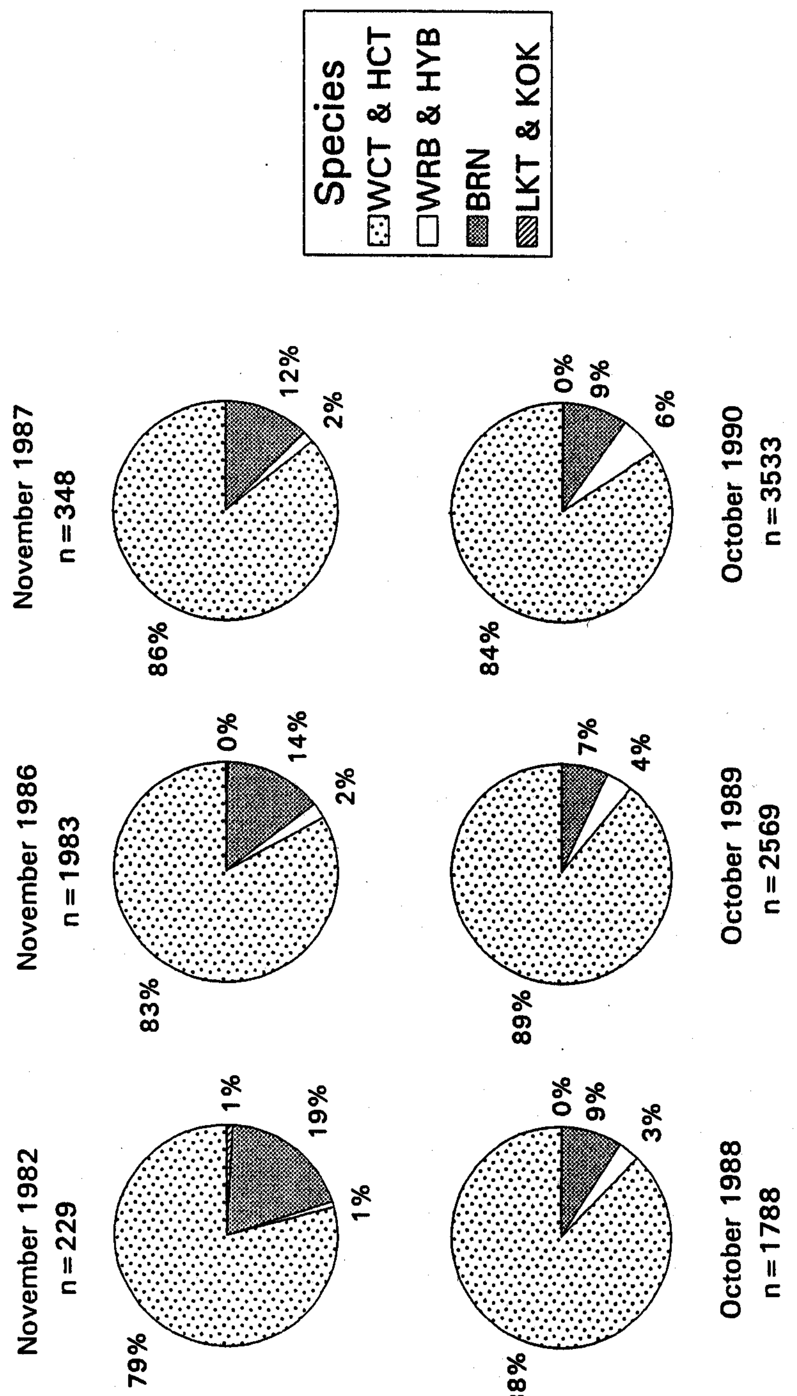

Figure 7. Trout species composition and relative abundance (%) at the Conant electrofishing section, South Fork Snake River, 1982-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish; 1982 results are from Moore and Schill (1984).

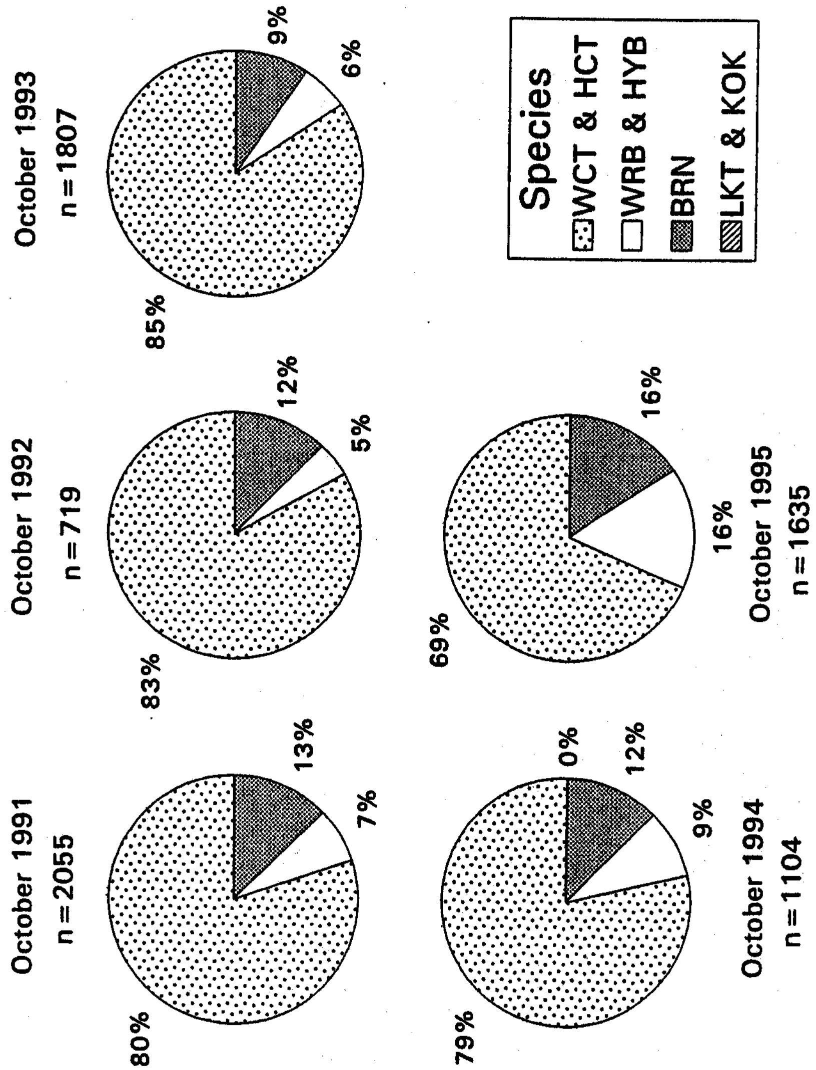

Figure 7. Continued.

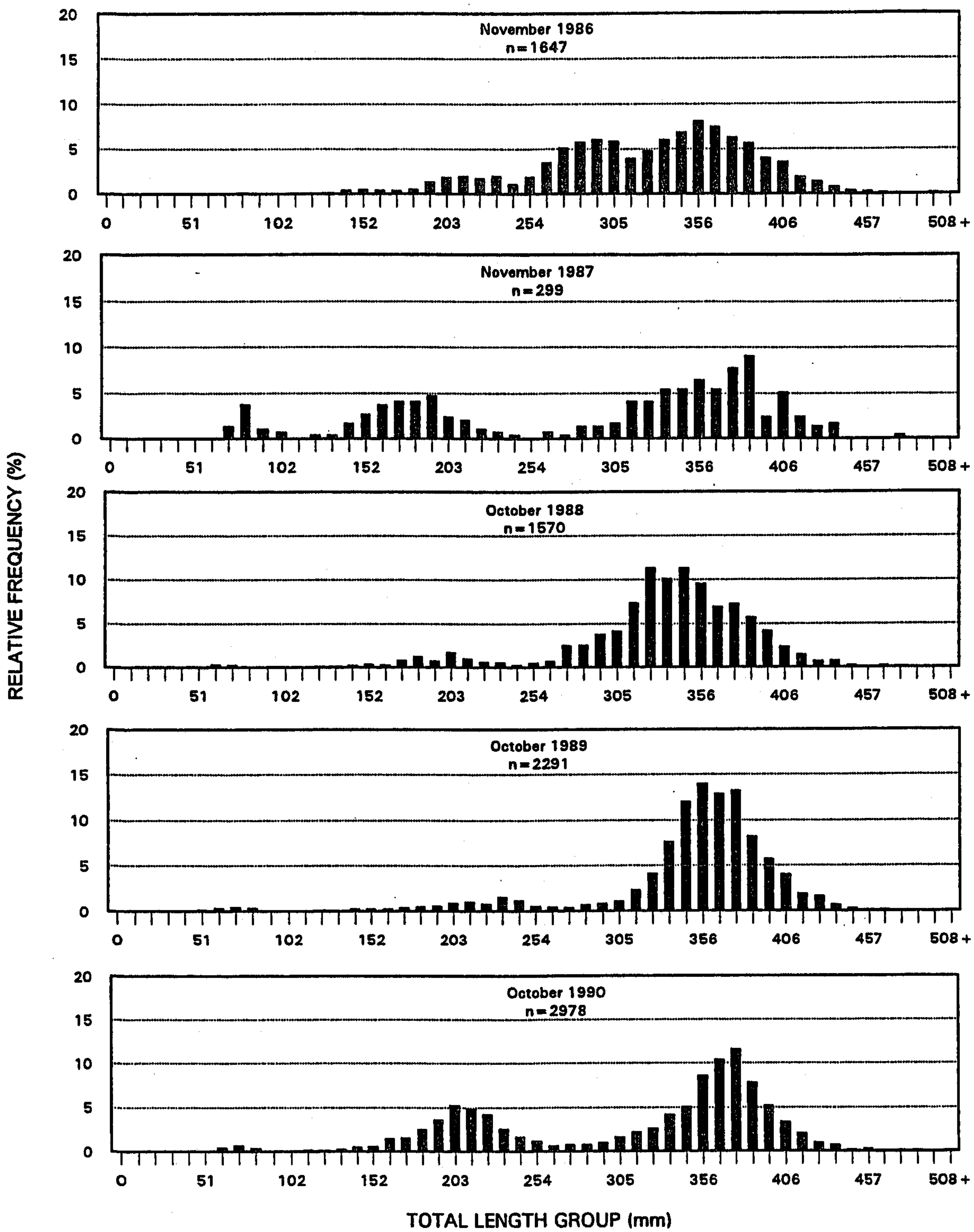

Figure 8. Relative length frequency distributions (%) of wild and hatchery cutthroat trout captured at the Conant electrofishing section, South Fork Snake River, 1986-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

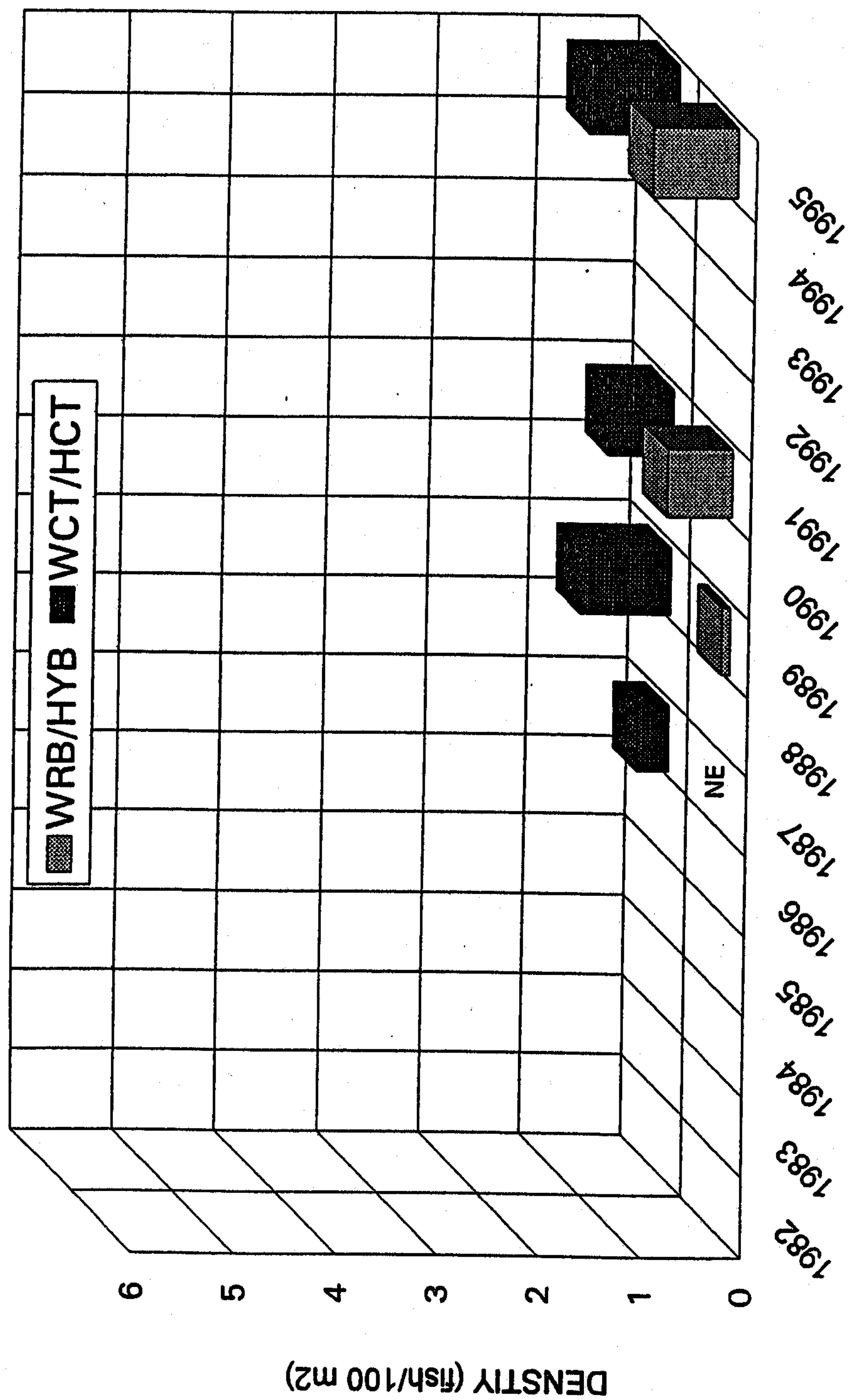

Figure 6. Estimated densities of rainbow and hybrid trout versus wild and hatchery cutthroat trout at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Density estimates are for age 1 and older (>100 mm) fish. NE = no estimate.

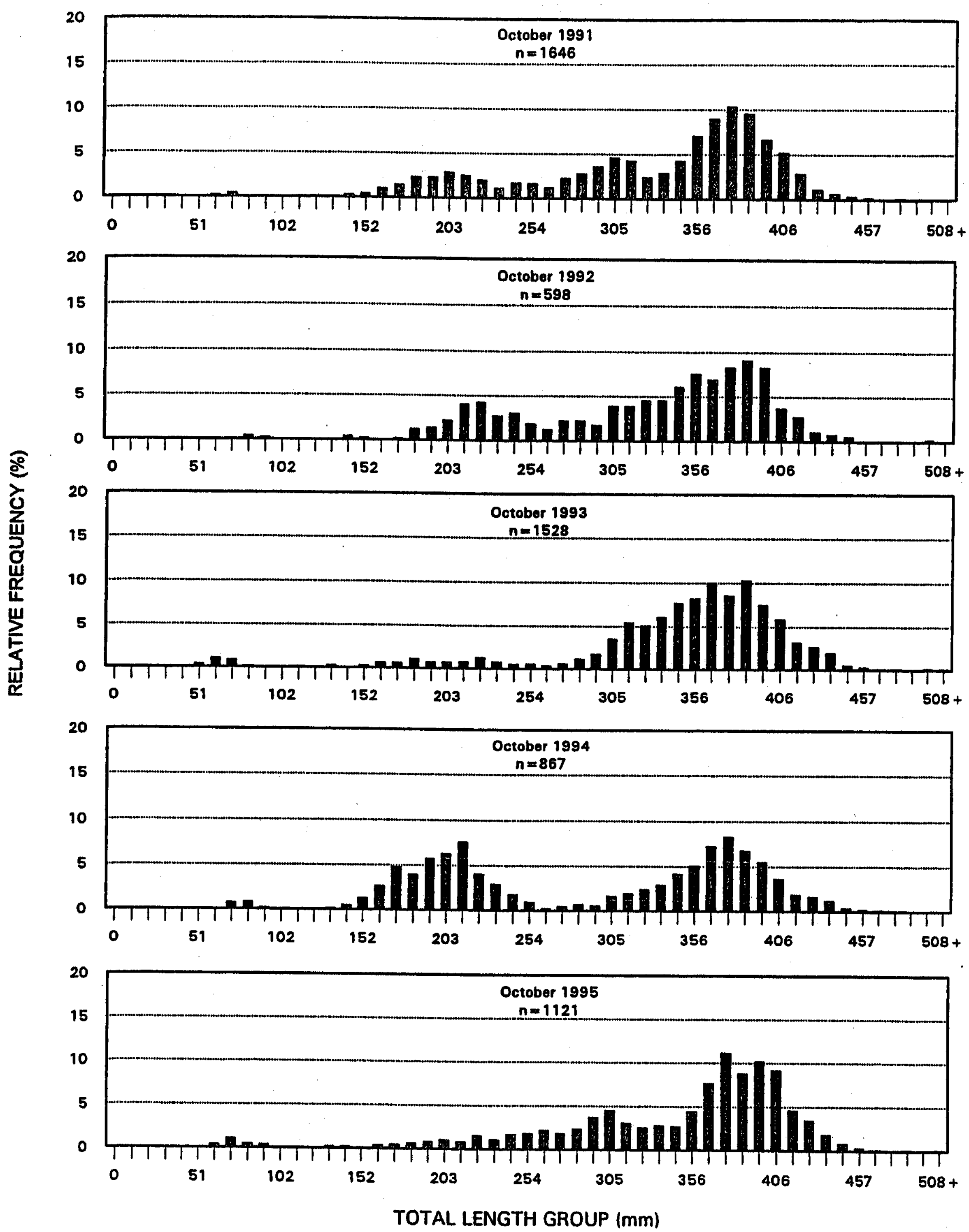

Figure 8. Continued.

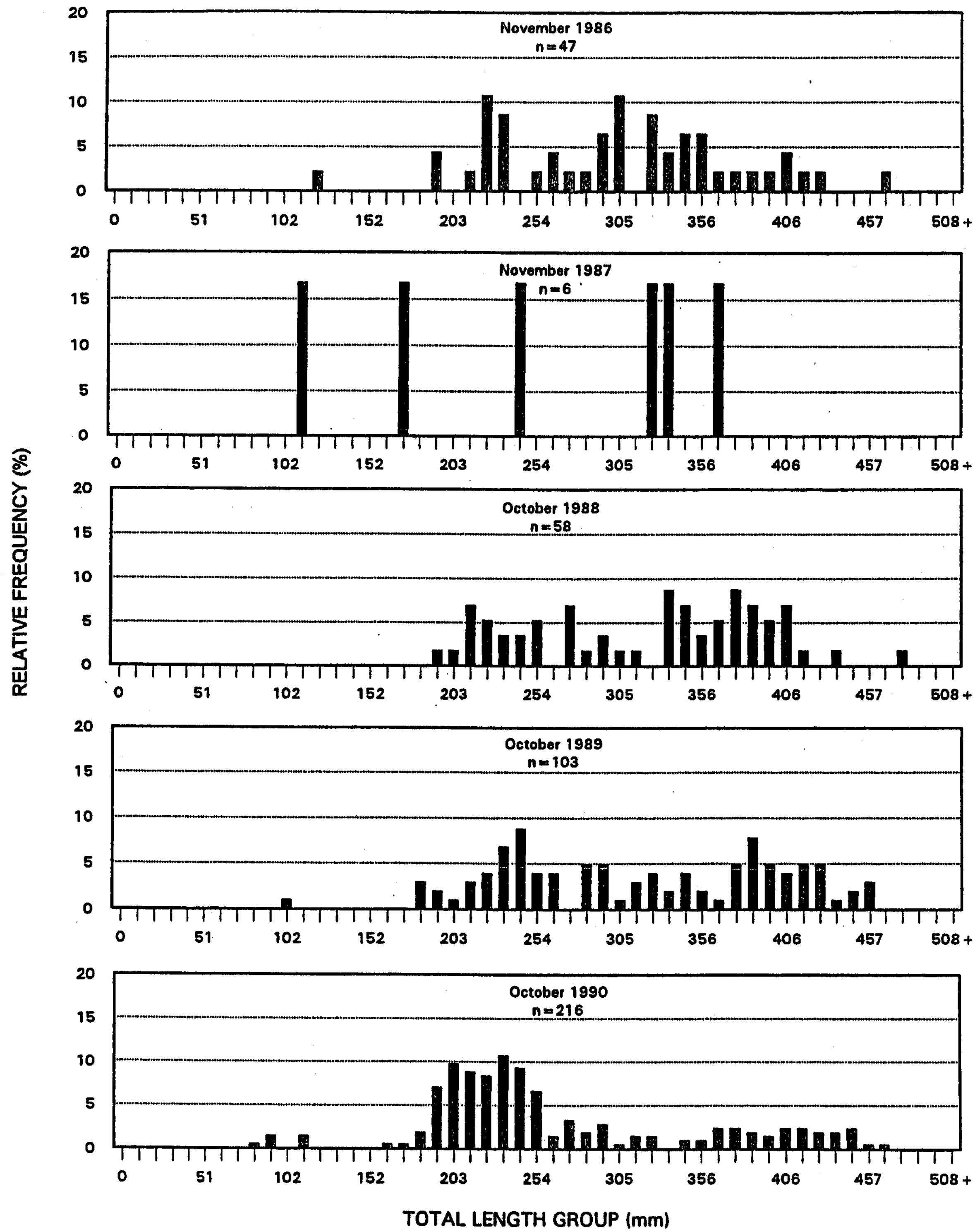

Figure 9. Relative length frequency distributions (%) of wild rainbow and hybrid trout captured at the Conant electrofishing section, South Fork Snake River, 1986-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

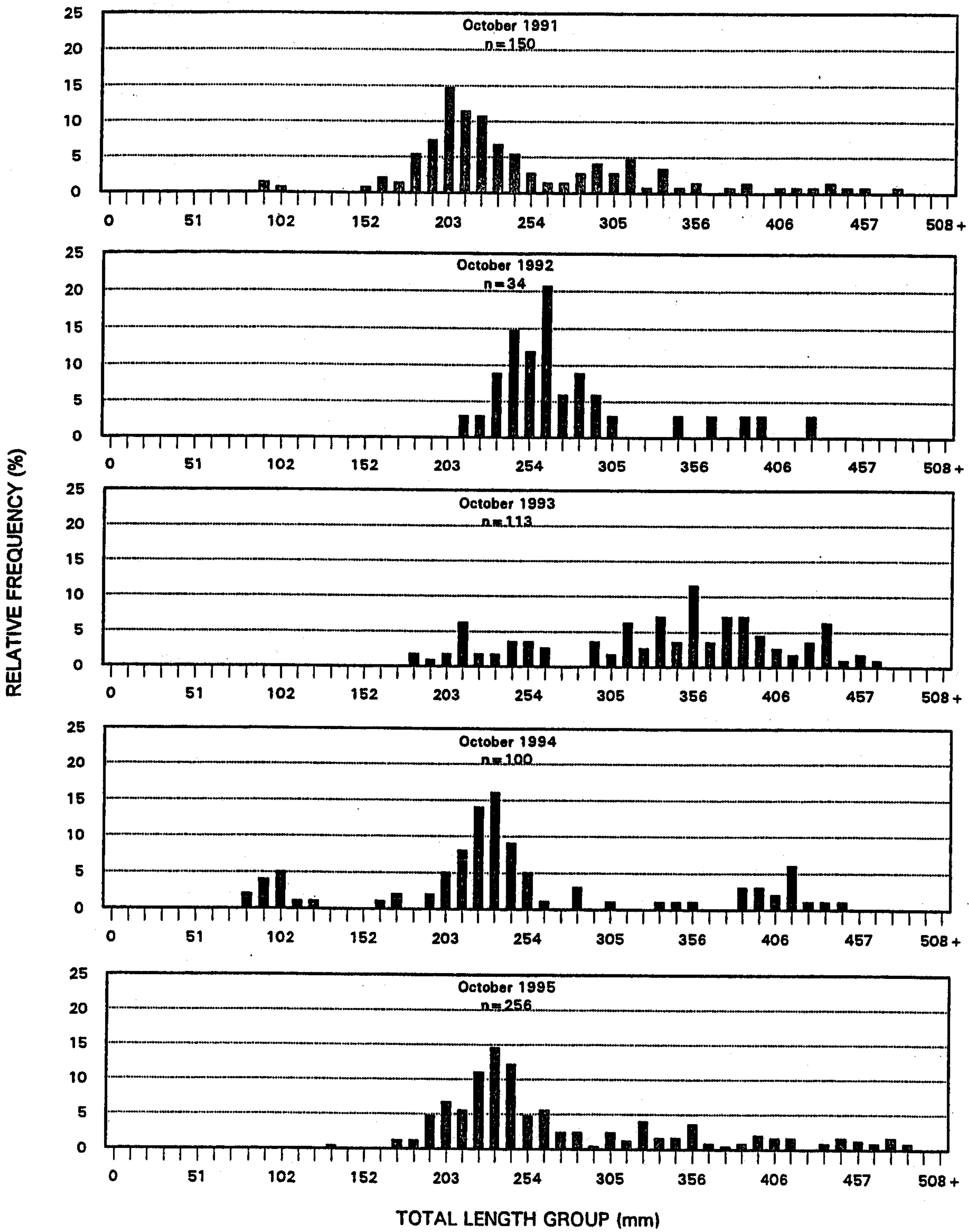

Figure 9. Continued.

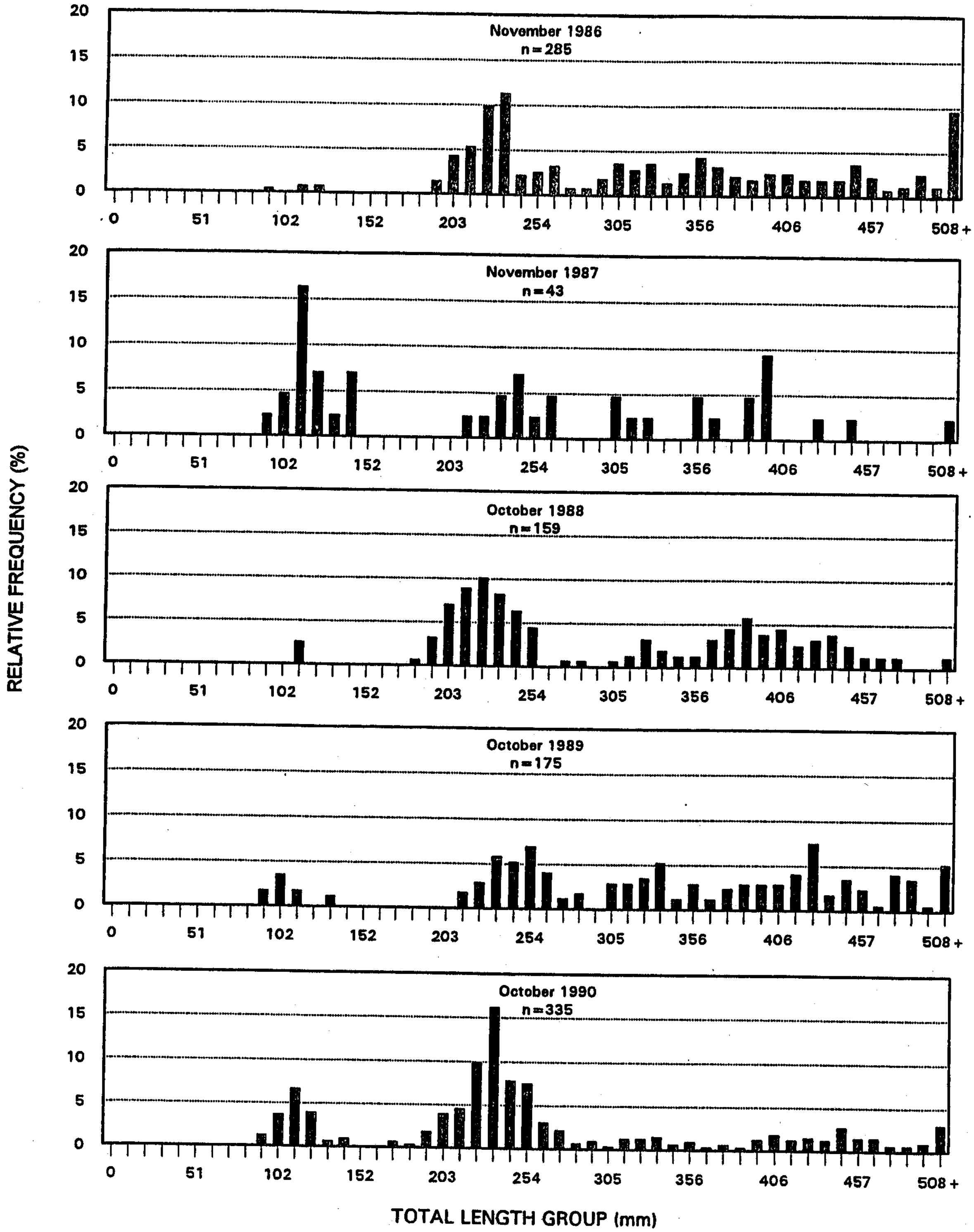

Figure 10. Relative length frequency distributions (%) of wild brown trout captured at the Conant electrofishing section, South Fork Snake River, 1986-1995. Total new fish captured during mark and recapture runs = n. Results are from MR4 database for all sizes of fish.

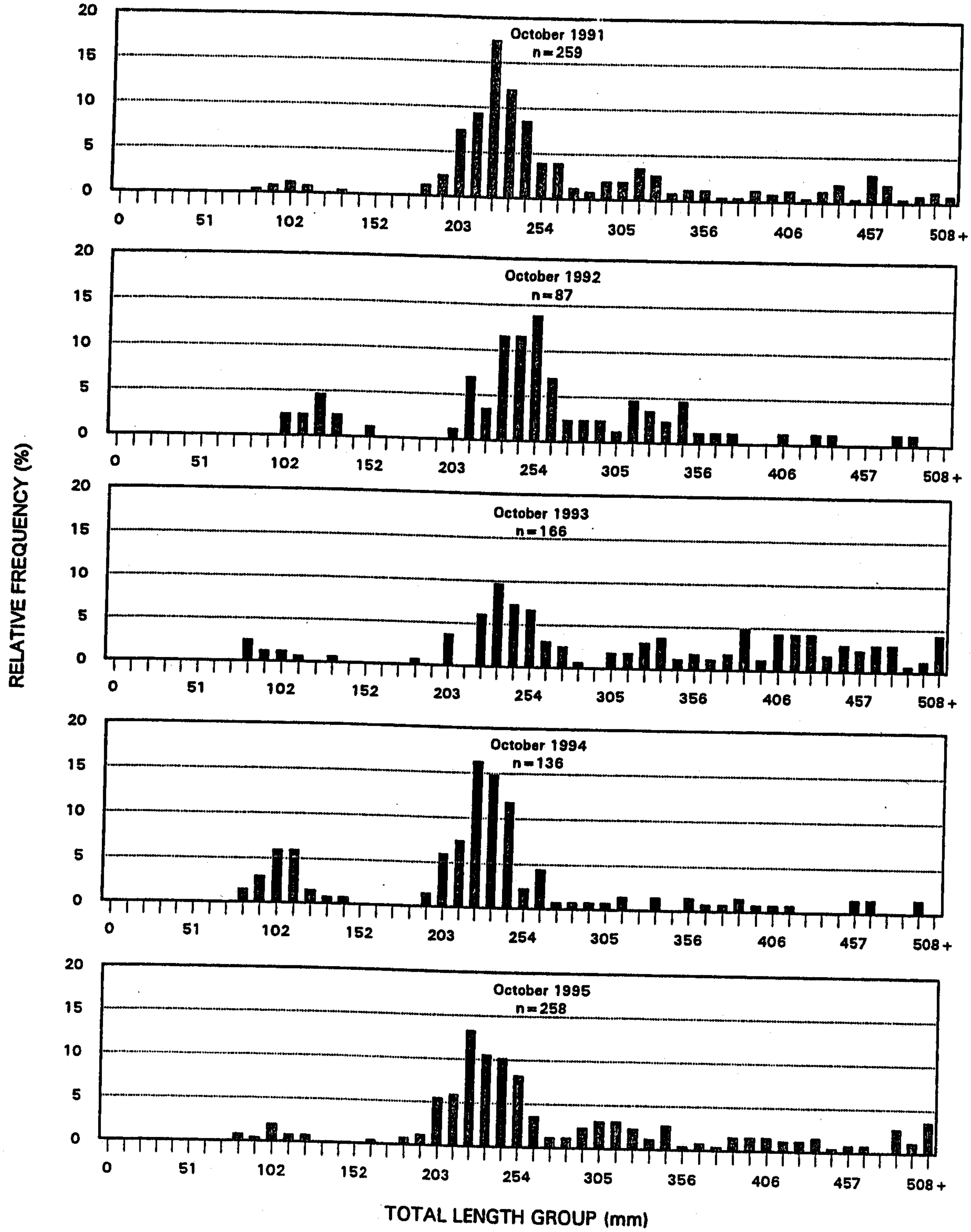

Figure 10. Continued.

both species since the late 1980s and would have expected an increase after special regulations were implemented in 1992. We note, however, that rainbow and hybrids are increasing in this section while brown trout are stable.

Results are confounded by lack of age and growth data and, for cutthroat trout, the inability to distinguish wild from hatchery fish. This will be resolved for future monitoring.

For 1995, average fish length was 351 mm for wild and hatchery cutthroat trout (n=1,121), 277 mm for rainbow and hybrid trout (n=256), 287 mm for brown trout (n=258), and 328 mm for all species combined (n=1,635; Appendix A-9). Quality Stock Density was 21.2% for wild and hatchery cutthroat trout, 10.6% for rainbow and hybrid trout, 15.8% for brown trout, and 18.7% for all species combined. Our QSD management goal of 20% has been met for cutthroat trout but not for all species combined.

Age 1 year class strengths strongly influence average fish lengths, as well as QSDs to a lesser extent, and may partly explain observed differences between the Palisades and Conant sections. However, numerous large fish (>450 mm) captured in the Palisades section (Figures 3-5) in contrast to the Conant section (Figures 8-10) suggests that growth rates may be higher at the former. This may be due to food such as *Mysis* is being flushed from the reservoir, less exploitation, or some other unknown factor. We will report on this in more detail next year when age and growth analysis is completed.

Density-For 1995, estimated density of age 1 and older fish was 172 fish/ha for wild and hatchery cutthroat trout (Appendix A-11); 38 fish/ha for rainbow and hybrid trout (Appendix A-12); 41 fish/ha for brown trout (Appendix A-13); and 239 fish/ha for all species combined (Appendix A-14). Age 1 and older fish were considered $\geq$102 mm for cutthroat, rainbow, and hybrid trout, and $\geq$152 mm for brown trout. These ages were corroborated using cross-sectioned otoliths and length frequency distributions. The calculated estimate for all species combined (239 fish/ha) is smaller than the summed estimates for all species (251 fish/ha).

Density of cutthroat trout was at its lowest since 1986 (Figure 11) but was higher than the 1982 estimate prior to special regulations. Density of rainbow and hybrid trout was at its highest since 1982. These results support trends reported above for relative abundance, and we consider them a serious threat to the genetic integrity and long-term viability of wild cutthroat trout populations in the South Fork Snake River.

In 1995, the Conant section cutthroat trout density was about twice that observed in the Palisades section, whereas rainbow and hybrid trout density was about half that observed in the Palisades section (Figures 6 and 11). We expect to discover the reason with a graduate research project beginning spring 1996.

Brown Trout Redd Counts

The annual brown trout aerial redd count was not conducted in 1995 due to unavailability of aircraft. However, recent counts have shown a downward trend since the record counts in 1991 (Appendix A-15).

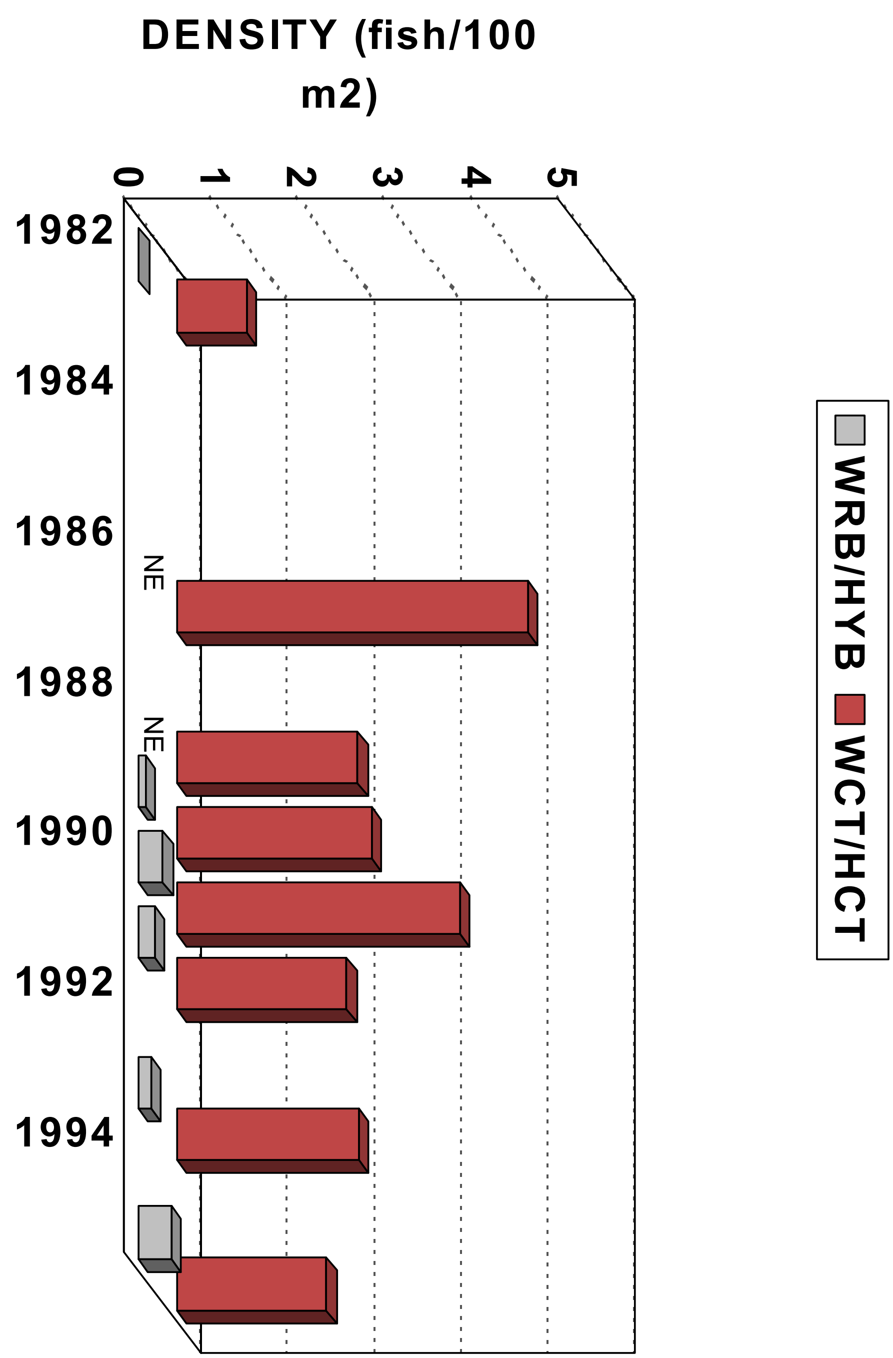

Figure 11. Estimated densities of rainbow and hybrid trout versus wild and hatchery cutthroat trout in the Conant electrofishing section, South Fork Snake River, 1982-1995. Density estimates are for age 1 and older (>100 mm) fish. NE = no estimate. Estimates for 1982 are from Moore and Schill (1984).

Age Corroboration

There was a greater range of ages assigned to fish when we used cross-sectioned otoliths than when we used either scales or surface-read otoliths (Table 6). For the wild/hatchery cutthroat trout sample (n=98), scale ages ranged from 1+ to 4+, surface otolith ages ranged from 1+ to 5+, and cross-sectioned otolith ages ranged from 1+ to 9+. For rainbow trout (n=86), both scale and surface otolith ages ranged from 0+ to 4+, but cross-sectioned otolith ages ranged from 1+ to 5+. For hybrid trout (n=72), scale ages ranged from 1+ to 5+, surface otolith ages ranged from 1+ to 4+, and cross-sectioned otolith ages ranged from 0+ to 7+. For brown trout (n=70), scale ages ranged from 0+ to 4+, surface otolith ages ranged from 0+ to 3+, and cross-sectioned otolith ages ranged from 0+ to 5+.

We were unable to age scales 6% of the time (Table 6). This included 5% of the time for wild/hatchery cutthroat trout, 6% for rainbow trout, 3% for hybrid trout, and 10% for brown trout. Scale samples were not aged if they were all regenerated or they did not leave a good imprint (upside down when pressed).

Nine percent of the time we were unable to surface-age otoliths (Table 6). This included 10% of the time for wild/hatchery cutthroat trout, 13% for rainbow trout, 10% for hybrid trout, and 3% for brown trout. Otolith samples were not surfaced-aged if they were both broken or if they were too clear or opaque. Although few were broken, this can be avoided by placing them directly in glycerin and water rather than in scale envelopes where they desiccate and become brittle.

Overall, we were unable to cross-section-age otoliths 15% of the time (Table 6). This included 8% of the time for wild/hatchery cutthroat trout, 22% for rainbow trout, 6% for hybrid trout, and 26% for brown trout. Otolith samples were not cross-section-aged when we destroyed them using a bent saw blade. Also, otoliths from fish <100 mm do not stay in the epoxy resin while sawing, and some otolith sections were too burnt to age after toasting. Several samples had only one otolith present and we did not cross-section them.

Two-thirds (66%) of the paired samples of scales and surface otoliths agreed to age (Table 7). We only used paired samples (n=277) where both scale age and surface otolith age determination were possible. Agreement ranged from 58% for wild/hatchery cutthroat trout to 74% for brown trout. Most disagreement was from surface otoliths being assigned older ages than scales (21%); the remainder was from the converse (13%). This was true for all species except rainbow trout.

In general, fewer (59%) of our paired samples of scales and cross-sectioned otoliths agreed to age (Table 8). We only used paired samples (n=259) where both scale age and cross-sectioned otolith age determination were possible. Agreement ranged from 45% for wild/hatchery cutthroat trout to 76% for hybrid trout. Like our results above, most disagreement was from cross-sectioned otoliths being assigned older ages than scales (30%); the remainder was from the converse (11%). This was true for all species except rainbow trout.

Less than half (49%) of our paired samples of scales and otoliths, both surface and cross-section read, agreed to age. We only used samples (n=229) where all three methods of age determination (scale, surface otolith, and cross-sectioned otolith) were possible. Agreement ranged from 29% for wild/hatchery cutthroat trout to 68% for hybrid trout.

Using cross-sectioned otoliths to age older (>age 0) trout in the South Fork Snake River gives the most reliable results, particularly for cutthroat trout. This method is more time-consuming than using scales and requires sacrificing the fish. However, scales are more difficult to read and the potential for

Table 6. Age frequency distribution as determined by scales, surface otoliths, and cross-sectioned otoliths. Paired samples of scales and otoliths were collected from electrofishing sections in the South Fork Snake River, September to October 1995.

Age	WCT/HCT[a]	WRB[a]	HYB[a]	BRN[a]	Total
			Scales		
Unread	5	5	2	7	19
0+	0	8	0	10	18
1+	29	43	47	33	152
2+	45	27	20	12	104
3+	15	2	2	7	26
4+	4	1	0	1	6
5+	0	0	1	0	1
Total	98	86	72	70	326
			Surface otoliths		
Unread	10	11	7	2	30
0+	0	9	0	14	23
1+	16	58	42	24	140
2+	34	5	13	17	69
3+	29	1	7	13	50
4+	7	2	3	0	12
5+	2	0	0	0	2
Total	98	86	72	70	326
			Cross-sectioned otoliths		
Unread	8	19	4	18	49
0+	0	0	2	2	4
1+	12	50	41	22	125
2+	34	10	16	18	78
3+	21	4	6	9	40
4+	11	0	2	0	13
5+	6	3	0	1	10
6+	1	0	0	0	1
7+	0	0	1	0	1
8+	3	0	0	0	3
9+	2	0	0	0	2
Total	98	86	72	70	326

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.

Table 7. Scale age versus surface otolith age for paired samples collected from electrofishing sections in the South Fork Snake River, September to October 1995. Sample size = n.

				Scale=surface oto		Scale<surface oto		Scale>surface oto	
Species[a]	Collected n	Both Read n	% unread	#	%	#	%	#	%
WCT/HCT	98	83	15	48	58	32	39	3	4
WRB	86	70	19	44	63	5	7	21	30
HYB	72	63	12	46	73	12	19	5	8
BRN	70	61	13	45	74	9	15	7	11
Total:	326	277	15	183	66	58	21	36	13

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.

Table 8. Scale age versus cross-sectioned otolith age for paired samples collected from electrofishing sections in the South Fork Snake River, September to October 1995. Sample size = n.

				Scale=x-section oto		Scale<x-section oto		Scale>x-section oto	
Species[a]	Collected n	Both Read n	% Unread	#	%	#	%	#	%
WCT/ HCT	98	85	13	38	45	45	53	2	2
WRB	86	63	27	36	57	13	21	14	22
HYB	72	66	8	50	76	10	15	6	9
BRN	70	45	36	28	62	10	22	7	16
Total:	326	259	21	152	59	78	30	29	11

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.

significant bias is high. Elle (1993) aged both scales and otoliths taken from 18 wild rainbow trout and found 39% disagreement. Like our results, most disagreement (33%) was from otoliths being assigned older ages than scales. Lorson and Marcinko (1988) also reported a 33% disagreement between scales and otoliths for brown trout, with scales underestimating age compared to otoliths. We note that our samples were biased towards smaller and younger fish that tend to be easier to age; disagreement would have probably been larger had we sampled a larger number of older fish.

Surface-aging whole otoliths seems to offer little advantage over scales and is less reliable than using cross-sections. Little additional time is required to cross-section them once they are collected and archived. We do not recommend surface-aging otoliths in the future.

Results from each section were pooled to give a larger sample size. We were unsure what differences to test for or how to test for them. We saw no reason why age corroboration would differ between sections.

Moore and Schill (1984) have done some age and growth work in the past on the South Fork Snake River. Using fish scales collected from wild cutthroat trout (n=385), brown trout (n=136), and mountain whitefish (n=143), they estimated age, body-scale regressions, back-calculated lengths at age, and annual growth increments. Cutthroat trout fry (n=43) captured in tributaries began forming scales at 42 to 52 mm (mean 47 mm). Based on a histogram of the number of circuli to the first annulus, they further concluded that most cutthroat trout fry form scales during the fall of their first year of life with no evidence of retarded scale formation. Results for brown trout were less conclusive. Their work was done prior to implementation of special regulations, but their results are probably still valid today. We will use 47 mm as length of squamation for cutthroat trout in our future age and growth work. We will also continue to assume retarded scale formation is not a problem and there are no missing annuli.

Species Identification and Hybridization

Species identification in the field based on morphology did not match identification in the lab based on genetics (Table 9; Appendix C). Of the 60 fish randomly sampled for identification error, 20 were identified in the field as cutthroat trout, 20 as rainbow trout, and 20 as hybrids of the two species. Protein resolution of tissues from these fish, however, indicated that 23 were pure Yellowstone cutthroat trout, 27 were pure rainbow trout, and 10 were hybrids. Thus, 14 of the 60 fish analyzed, or 23%, were misidentified in the field.

Species identification error appears to be large, but it does not significantly affect the population trends we have described for the following reasons. First, most identification error (11 fish or 18% of the sample) was between rainbow and hybrid trout (Table 9). But we anticipated this and grouped them for the population trend analyses. Nine fish identified as hybrids were actually pure rainbow trout, whereas the converse was true for two fish. We conclude that rainbow and hybrid trout cannot be accurately distinguished in the field and should continue to be grouped. Second, all fish that we identified in the field as cutthroat trout were pure (Table 9). However, some fish that we identified as hybrids were actually pure cutthroat trout, and this was the remaining source of identification error (3 fish or 5% of the sample). This error does affect the population trends that we have described, but not significantly so. For example, we captured 256 rainbow and hybrid trout in the Conant section in 1995 for 16% of the total (1,635). Applying an identification error correction factor to the number captured (not the percent) gives the following:

Identification error correction factor	=	$\frac{\text{3 fish misidentified}}{\text{40 rainbow and hybrid}}$	= 7.5%
256 rainbow and hybrid trout captured x 7.5%	=	19 fish misidentified in 1995	
256 rainbow and hybrid trout captured - 19	=	237 actual, or 14% of total	
1,121 cutthroat trout captured + 19	=	1,140 actual, or 70% of total	

Table 9. Results of electrophoresis analysis of Yellowstone cutthroat trout (n=20), rainbow trout (n=20), and hybrid rainbow x cutthroat trout (n=20) randomly sampled from the Conant electrofishing section, South Fork Snake River, October 12 and 13, 1995. Genetics analysis was done by Wild Trout and Salmon Genetics Lab, University of Montana, Missoula. All sampled fish were wild, but rainbow trout are progeny of unknown hatchery stock.

			Field ID = genetic ID (agreement)		Field ID = genetic ID (disagreement)	
Trout species	# field ID	# genetic ID	#	%	#	%
Yellowstone cutthroat	20	23	20	100	0	0
Rainbow	20	27	18	90	2[c]	10
Hybrid	20	10[a]	8[b]	40	12[d]	60
	60	60	46	77	14	23

[a] Of 10 identified as hybrids by electrophoresis, 4 were F1 progeny and 6 were backcrosses or F2 progeny.
[b] Of 8 agreements, 4 were F1 progeny and 4 were backcrosses or F2 progeny.
[c] Both disagreements were identified in field as rainbow trout but by electrophoresis as hybrid trout (backcrosses or F2 progeny).
[d] Of 12 disagreements, all were identified in field as hybrid trout, but by electrophoresis 3 were identified as cutthroat trout and 9 as rainbow trout.

We reported 16% for rainbow and hybrid trout and 69% for cutthroat trout, a minor difference from the above and probably not statistically significant (Figure 7). For the Palisades section in 1995, using the same correction factor reduced relative abundance of rainbow and hybrid trout from 33% to 30% and increased relative abundance of cutthroat trout from 60% to 63% (Figure 2), we reported again a minor and probably not statistically significant difference.

Our data shows hybridization is occurring in the South Fork Snake River, and hybrids are fertile (Table 9). Of the ten hybrids identified by electrophoresis, four were F1 progeny and six were F2 progeny or backcrosses. F1 progeny are the offspring of pure parents, F2 progeny are the offspring of F1 parents, and backcrosses are the offspring of one pure parent and one F1 parent. If hybrids were sterile, there would be no F2 progeny or backcrosses.

Whirling Disease

Presence of the whirling disease parasite *Myxobolus cerebralis* was confirmed positive for rainbow trout collected in the Palisades section of the South Fork Snake River in 1995 (Table 10; Appendix D). Lab test results were also presumptive positive for hybrid and cutthroat trout collected in this section. Results were negative for mountain whitefish collected in this section and the Lorenzo section. They were also confirmed negative for brown trout collected in the Lorenzo section. We note that rainbow trout cannot be accurately distinguished from hybrid trout in the field, and lab results for the two may be the same.

Table 10. Whirling disease results of trout and mountain whitefish sampled in South Fork Snake River electrofishing sections, September to October 1995. Analysis was done by Idaho Department of Fish and Game Fish Health Lab, Eagle, Idaho.

Species/results	Lorenzo	Conant	Palisades
WCT\HCT: [a]			
Accession #			95-514
Digestion			+
Histology			-
n=			67
WRB: [a]			
Accession #			95-515
Digestion			+
Histology			+
n=			70
HYB: [a]			
Accession #			95-517
Digestion			+
Histology			-
n=			53
BRN: [a]			
Accession #	95-513		
Digestion	-		
Histology	-		
n=	65		
MWF: [a]			
Accession #	95-512		95-518
Digestion	-		-
Histology	NA		NA
n=	75		53

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout; MWF = mountain whitefish.

The Department's Fish Health Lab used a standard two-stage process to diagnose fish for presence of the parasite. "Confirmed" positive means that the myxosporean *Myxobolus cerebralis* (Syn. *Myxosoma cerebralis*) was detected by histological examination of cranial tissue. "Presumptive" positive means that it was not but that spores were detected in the initial digestion process. These spores can be of a variety of common myxosporeans and, if detected, fish are then subjected to later histological examination for confirmation of *M. cerebralis*.

We believe our results are particularly significant in light of the current whirling disease debate. The proportion of rainbow and hybrid trout has steadily increased from 6% to 33% in the Palisades section since 1987 (Figure 2) and from 1% to 16% in the Conant section since 1982 (Figure 7). Age 1 and older densities have steadily increased from 0.09 to 0.85 fish/ha in the Palisades section (Figure 6) and from 0.09 to 0.38 fish/ha in the Conant section (Figure 11). Significant recruitment is occurring at both sections as evidenced by strong year classes of age 1 fish prior to and including 1995 (Figures 4 and 9). All evidence suggests an expanding population of rainbow and hybrid trout. If there are population impacts from whirling disease they have yet to be manifested in the South Fork Snake River.

We note that the protozoan parasite *Henneguya spp.* was detected in one group of five mountain whitefish collected at Palisades in 1995.

Rainey Creek Fry Trapping

Significant numbers (208) of wild cutthroat trout fry were captured moving downstream in upper Rainey Creek from mid-September to early October 1995 (Figure 12). Fewer yearlings (8) and no adults were captured. Relative proportions were similar in 1994 (941 fry, 42 yearlings, and 15 adults) even though we trapped two months more. Streamflows were lower in 1994 (a drought year) than in 1995 (above normal precipitation).

Moore (1980, 1981) captured only four cutthroat trout (age unknown) at a weir and at a Krey-Meekin trap operated in lower Rainey Creek from June 30 to October 12, 1980. Large mats of drifting aquatic vegetation confounded his results by continually clogging and occasionally washing out the gear. However, little movement of trout was detected when the gear was operating properly. When the Krey-Meekin trap was moved to upper Rainey Creek (near our trap location), only 12 cutthroat trout fry were captured from October 23 to November 7, 1980. Moore and Schill (1984) also captured significantly fewer numbers of cutthroat trout fry (27), juveniles (56), and adults (8), than we did after moving their weir upstream (location unknown) and operating it from March 17 to December 14, 1981.

It is unknown to what extent outmigration occurred prior to mid-September or after early October when the traps were not operating (Figure 12). However, outmigration timing in 1994 and 1995 was significantly different from that observed in 1981 when most downstream movement occurred prior to mid-July and ceased completely by early August (Moore and Schill 1984). The authors noted this timing was much different from that observed for other South Fork Snake River tributaries and speculated it was due to high spring flows pushing resident fish downstream rather than actual outmigration to the South Fork Snake River.

Fish moved mostly at night during both 1994 and 1995.

Cutthroat trout moving downstream in 1995 were mostly age 0 fry (<102 mm; Figure 13). Scale samples were not taken to age fish. The average size of all captured fish was 43 mm, but the median was 30 mm (n=216). Average fish size was smaller in 1995 than in 1994 (mean=53 mm, n=998), but the median was the same. This probably reflects fewer adults being trapped. The length frequency distribution and average size were similar to that reported for outmigrants trapped in Burns and Pine creeks in the early 1980s (Moore and Schill 1984).

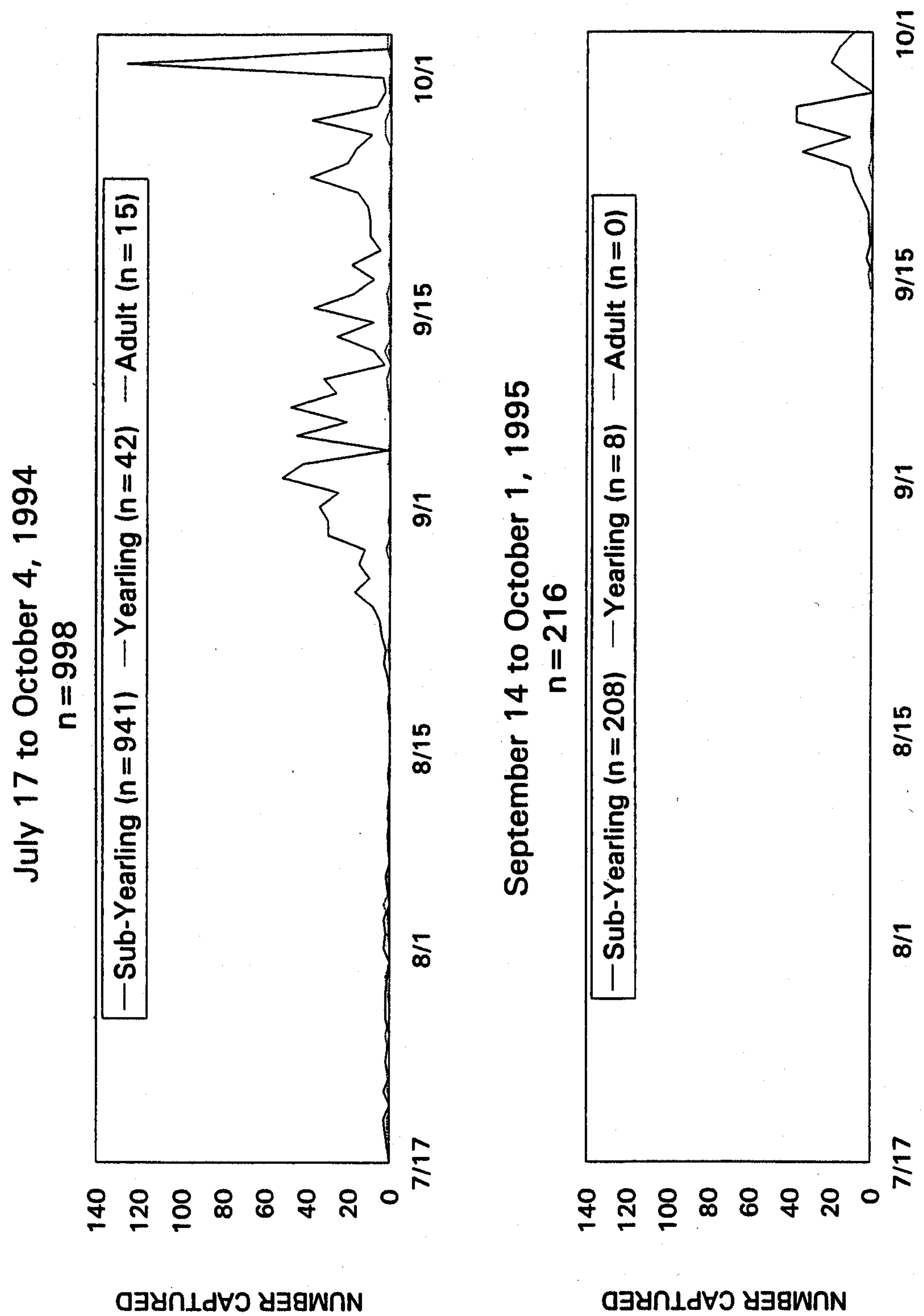

Figure 12. Number of wild cutthroat trout fry (<100 mm), yearlings (100-250 mm), and adults (>250 mm) captured daily moving downstream in Rainey Creek, 1994 and 1995. Ages are approximate and were not validated.

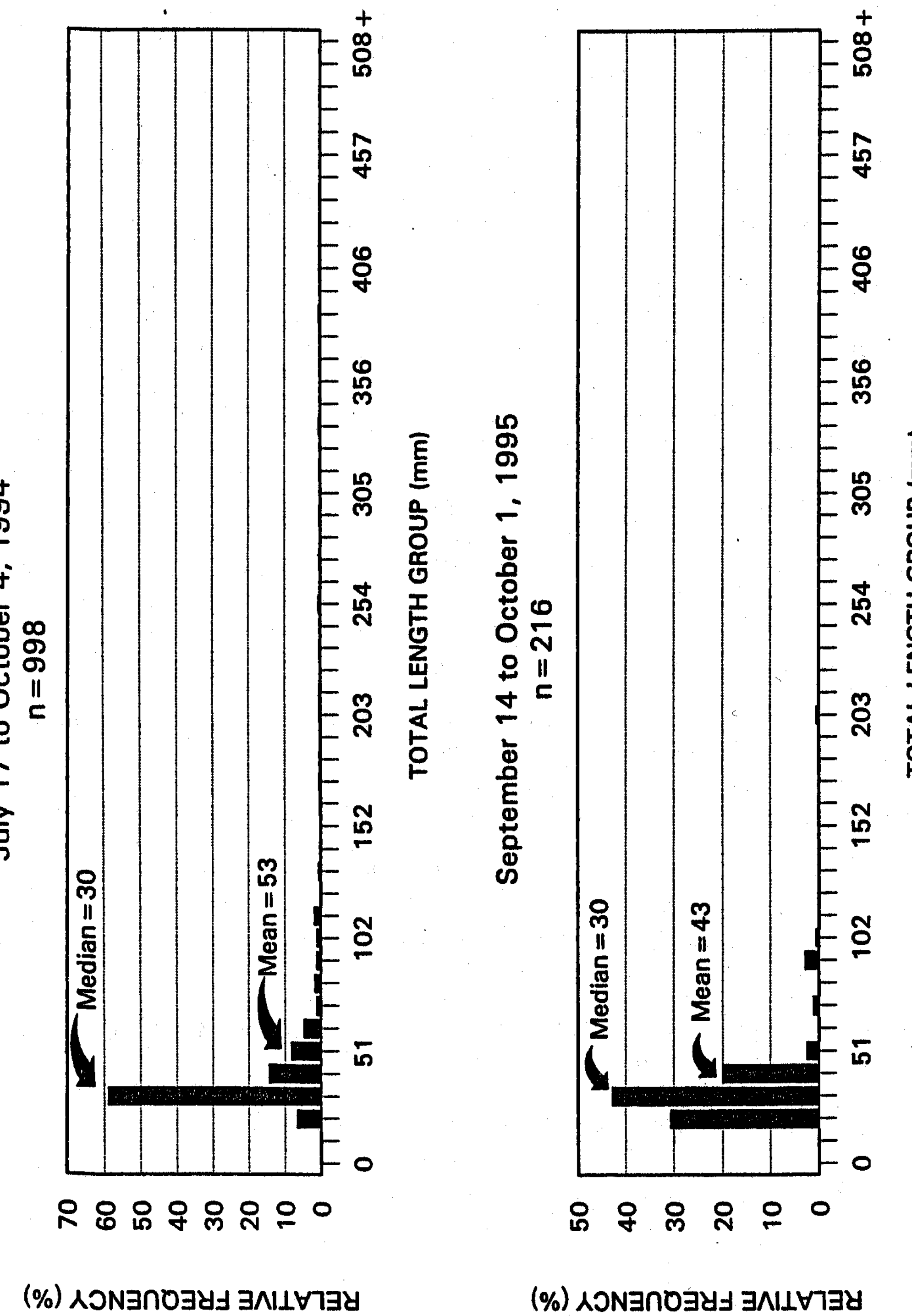

Figure 13. Relative length frequency distributions (%) of wild cutthroat trout captured moving downstream in Rainey Creek, 1994 and 1995.

RECOMMENDATIONS

1. Continue monitoring South Fork Snake River wild trout populations in the mainstem by electrofishing. Analyze Lorenzo section data from 1987 through 1995. Correlate estimated numbers of brown trout adults at all electrofishing sections with redd counts. Discontinue redd counts if there is a poor correlation.

2. Develop length-weight regressions for each wild trout species using electrofishing data collected in 1994 and 1995. Test for significant spatial (between sections) and temporal (between years) differences. Predict fish weights from measured lengths and estimate biomass and standing crops for all sections and years. Analyze for significant trends.

3. Use cross-sectioned otoliths to back-calculate length-at-age and annual increment of growth. Use the DISBCAL 89 program (Frie 1982; Missouri Department of Conservation 1989) to digitize scales and analyze data. Mark a large group of known-age fish to validate aging techniques.

4. Continue genetic sampling of wild cutthroat, rainbow, and hybrid trout populations to determine extent of genetic introgression. Assess what level of introgression causes reduced levels of cutthroat trout fitness or performance. Continue to develop accurate methods to identify these two species and their hybrid in the field, including age 0 fish.

5. Initiate and coordinate graduate student research on rainbow and hybrid trout life history. Identify vulnerable stages (especially reproductive) of rainbow and hybrid trout populations, and develop effective methods for control of this expanding and non-native species. Identify and protect remaining populations of native cutthroat trout in the mainstem and tributaries.

6. Coordinate with in-house Yellowstone Cutthroat Trout Management Team on management and research guidelines. Change and simplify regulations to allow general harvest of rainbow, hybrid, and brown trout in the mainstem. Assess special cutthroat trout regulations and spawning closures in tributaries. Model population dynamics in Wild Trout Workshop using MOCPOP.

7. Determine extent of recruitment to the riverine fishery (below Palisades Dam) from stocks in the reservoir, particularly hatchery finespotted cutthroat trout. Explore factors affecting this recruitment such as extent of reservoir drawdown. Develop accurate methods to differentiate reservoir fish from riverine fish, and hatchery fish from wild fish.

8. Continue sampling for presence of the whirling disease parasite. Continue monitoring for possible disease outbreaks and population-level impacts.

9. Conduct fully randomized creel census as soon as funding is available.

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APPENDICES

Appendix A. Summary of South Fork Snake River mainstem trout population statistics, 1986-1995.

Appendix A-1. Trout species composition and relative abundance (%) at the Palisades electrofishing section, South Fork Snake River, September, 1987-1995. Total individual fish captured during mark and recapture runs is in parentheses. Results are from MR4 database for all sizes of fish.

Year	WCT & HCT[a,b]	WRB & HYB[a]	BRN[a]	LKT[a,b]	KOK[a,b]	Total
1987[c]	62 (188)	6 (19)	31 (94)	0 (0)	0 (0)	99 (301)
1989	82 (824)	10 (97)	8 (84)	<1 (1)	0 (0)	100 (1006)
1991	71 (681)	22 (213)	6 (60)	<1 (1)	0 (0)	99 (955)
1994[d,e]	62 (572)	33 (307)	4 (38)	<1 (1)	0 (0)	99 (918)
1995[d]	60 (785)	33 (426)	7 (88)	<1 (1)	<1 (3)	100 (1303)

[a] WCT=wild cutthroat trout; HCT=hatchery cutthroat trout; WRB=wild rainbow trout; HYB=wild rainbow x cutthroat hybrid trout; BRN=wild brown trout; LKT=lake trout; KOK=kokanee salmon.

[b] HCT, LKT, and KOK are believed to emigrate from Palisades Reservoir and numbers are directly related to extent of drawdown.

[c] Electrofishing conducted during March.

[d] Electrofishing conducted from Sheep Creek to Palisades Creek; section length reduced from 5.1 km to 5.0 km.

[e] Only two marking and no recapture runs done due to high flows.

Appendix A-2. Mean total length and quality stock density (QSD, %) of wild trout captured at the Palisades electrofishing section, South Fork Snake River, September, 1987-1995. Total individual fish captured during mark and recapture runs = n. QSD = (number >16 in/number >8 in) x 100. Results are from MR4 database for all sizes of fish.

Year	WCT/HCT[a,b]			WRB/HYB[a]			BRN[a]			All[b,c]		
	n	0 (in)	QSD	n	0 (in)	QSD	n	0 (in)	QSD	n	0 (in)	QSD
1987[d]	188	12.8	9.2	19	10.4	21.4	94	16.1	44.7	301	13.7	21.2
1989	824	13.8	22.2	97	12.4	31.3	84	11.6	18.0	1006	13.4	22.7
1991	681	13.5	30.7	213	10.0	11.8	60	10.4	12.0	955	12.5	26.7
1994[e,f]	572	11.9	34.7	307	9.7	13.6	38	10.3	5.3	918	11.1	26.0
1995[e]	785	12.4	30.7	426	10.3	14.0	88	11.0	4.6	1303	11.6	23.6

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.
[b] HCT, LKT, and KOK are believed to emigrate from Palisades Reservoir and numbers are directly related to extent of drawdown.
[c] Includes lake trout (LKT) and kokanee salmon (KOK).
[d] Electrofishing conducted during March.
[e] Electrofishing conducted from Sheep Creek to Palisades Creek; section length reduced from 5.1 km to 5.0 km.
[f] Only two marking and no recapture runs done due to high flows.

Appendix A-3. Range of flows, mean flow, and electrofishing sampling efficiencies (R/C) at the Palisades section, South Fork Snake River, 1987-1995. Flows were recorded at the USGS Irwin gage. Electrofishing results are from MR4 database for all sizes of fish.

Sampling dates	Range of flows (cfs)	Mean flow (cfs)	WCT & HCT[a,b]				WRB & HYB[a]				BRN[a]				All[b,c]				Catch rate (fish/ day)[d]
			M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	
1987: 3/ 17,18,23	1030-1070	1050	115	81	8	10	7	13	1	8	68	28	2	7	190	122	11	9	104
1989: 9/ 20,21,28	5170-7000	6290	600	289	65	22	64	41	8	20	61	33	10	30	725	364	83	23	363
1991: 9/ 4,5,11	8130-8600	8440	504	235	58	25	150	67	4	6	52	14	6	43	706	317	68	21	341
[e,f]1994: 9/19,20	6400-6420	6410	572	--	--	--	307	--	--	--	38	--	--	--	918	--	--	--	459
[e]1995: 9/19,20, 28,29	5570-7300	6500	498	346	59	17	253	191	18	9	53	42	7	17	807	580	84	14	347

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.
[b] HCT, LKT, and KOK are believed to emigrate from Palisades Reservoir and numbers are directly related to extent of drawdown.
[c] Includes lake trout (LKT) and kokanee salmon (KOK).
[d] Includes recaptured fish; catch rate=(M+C)/number days sampled.
[e] Electrofishing conducted from Sheep Creek to Palisades Creek; section length reduced from 5.1 km to 5.0 km.
[f] No recapture runs due to high flows.

Appendix A-4. Estimated abundance (N) of age 1 and older (∃ 4 in) wild and hatchery cutthroat trout at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	Ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
3/17/87	3.17	5.1	40.4	1025	1287 (302)	323	406	201	252	25	32	0.25	0.32
9/20/89	3.17	5.1	40.4	2622	3640 (257)	827	1148	514	714	65	90	0.65	0.90
9/4/91	3.17	5.1	40.4	2015	2588 (168)	636	816	395	507	50	64	0.50	0.64
9/19/94	3.11	5.0	39.6	---[a]	---	---	---	---	---	---	---	---	---
9/19/95	3.11	5.0	39.6	2829	3558 (252)	910	1144	566	712	71	90	0.71	0.90

[a] No estimate; recapture runs not made.

Appendix A-5. Estimated abundance (N) of age 1 and older (∃ 4 in) wild rainbow and hybrid trout at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	Ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
3/17/87	3.17	5.1	40.4	---[a]	---	---	---	---	---	---	---	---	---
9/20/89	3.17	5.1	40.4	263	361 (87)	83	114	52	71	7	9	0.07	0.09
9/4/91	3.17	5.1	40.4	2039	2653 (1252)	643	837	400	520	50	66	0.50	0.66
9/19/94	3.11	5.0	39.6	---[b]	---	---	---	---	---	---	---	---	---
9/19/95	3.11	5.0	39.6	2466	3379 (515)	793	1086	493	676	62	85	0.62	0.85

[a] Unbiased estimate not possible as R < 3 (Ricker 1975).
[b] No estimate; recapture runs not made.

Appendix A-6. Estimated abundance (N) of age 1 and older ∃6 in) wild brown trout at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
3/17/87	3.17	5.1	40.4	---[a]	---	---	---	---	---	---	---	---	---
9/20/89	3.17	5.1	40.4	191	---[b]	60	---	37	---	5	---	0.05	---
9/4/91	3.17	5.1	40.4	113	---[b]	36	---	22	---	3	---	0.03	---
9/19/94	3.11	5.0	39.6	---[c]	---	---	---	---	---	---	---	---	---
9/19/95	3.11	5.0	39.6	289	---[b]	93	---	58	---	7	---	0.07	---

[a] Unbiased estimate not possible as R < 3 (Ricker 1975).
[b] No estimate; log-likelihood model not suitable.
[c] No estimate; recapture runs not made.

Appendix A-7. Estimated abundance (N) of all trout ∃4 in (including lake trout and kokanee salmon) at the Palisades electrofishing section, South Fork Snake River, 1987-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
3/17/87	3.17	5.1	40.4	1957	1966 (372)	617	620	384	385	48	49	0.48	0.49
9/20/89	3.17	5.1	40.4	3102	3585 (167)	979	1131	608	703	77	89	0.77	0.89
9/4/91	3.17	5.1	40.4	3248	4273 (274)	1025	1348	637	838	80	106	0.80	1.06
9/19/94	3.11	5.0	39.6	---[a]	---	---	---	---	---	---	---	---	---
9/19/95	3.11	5.0	39.6	5389	6701 (394)	1733	2155	1078	1340	136	169	1.36	1.69

[a] No estimate; recapture runs not made.

Appendix A-8. Trout species composition and relative abundance (%) at the Conant electrofishing section, South Fork Snake River, October, 1982-1995. Total individual fish captured during mark and recapture runs is in parentheses. Results are from MR4 database for all sizes of fish.

Year	WCT & HCT[a,b]	WRB & HYB[a]	BRN[a]	LKT[a,b]	KOK[a,b]	Total
1982[c,d,e]	79 (181)	1 (2)	19 (44)	1 (2)	0 (0)	100 (229)
1986[d]	83 (1647)	2 (47)	14 (285)	<1 (4)	0 (0)	99 (1983)
1987[d,f,g]	86 (299)	2 (6)	12 (43)	0 (0)	0 (0)	100 (348)
1988	88 (1570)	3 (58)	9 (159)	<1 (1)	0 (0)	100 (1788)
1989	89 (2291)	4 (103)	7 (175)	0 (0)	0 (0)	100 (2569)
1990	84 (2978)	6 (216)	9 (335)	<1 (4)	0 (0)	99 (3533)
1991	80 (1646)	7 (150)	13 (259)	0 (0)	0 (0)	100 (2055)
1992[h]	83 (598)	5 (34)	12 (87)	0 (0)	0 (0)	100 (719)
1993	85 (1528)	6 (113)	9 (166)	0 (0)	0 (0)	100 (1807)
1994[f]	79 (867)	9 (100)	12 (136)	0 (0)	<1 (1)	100 (1104)
1995	69 (1121)	16 (256)	16 (258)	0 (0)	0 (0)	101 (1635)

[a] WCT=wild cutthroat trout; HCT=hatchery cutthroat trout; WRB=wild rainbow trout; HYB=wild rainbow x cutthroat hybrid trout; BRN=wild brown trout; LKT=lake trout; KOK=kokanee salmon.
[b] HCT, LKT, and KOK are believed to emigrate from Palisades Reservoir and numbers are directly related to extent of drawdown.
[c] Only 1.9 km of larger 4.9 km section was electrofished.
[d] Electrofishing conducted in early November.
[e] From Moore and Schill (1984), not MR4 database.
[f] Only two marking and no recapture runs done due to low flows.
[g] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.
[h] Only one marking and no recapture runs done due to low flows.

Appendix A-9. Mean total length and quality stock density (QSD, %) of wild trout captured at the Conant electrofishing section, South Fork Snake River, October, 1986-1995. Total individual fish captured during mark and recapture runs = n. QSD = (number >16 in/number >8 in) x 100. Results are from MR4 database for all sizes of fish.

Year	WCT/HCT[a,b]			WRB/HYB[a]			BRN[a]			All[b,c]		
	n	0 (in)	QSD	n	0 (in)	QSD	n	0 (in)	QSD	n	0 (in)	QSD
1986[d]	1647	13.0	8.5	47	12.1	11.4	285	13.3	29.0	1983	13.0	11.5
1987[d,e,f]	299	11.7	14.9	6	10.3	0.0	43	9.8	11.5	348	11.5	14.3
1988	1570	13.3	5.6	58	12.9	12.3	159	12.2	22.8	1788	13.2	7.3
1989	2291	13.9	8.8	103	12.7	19.6	175	13.5	38.5	2569	13.8	11.2
1990	2978	12.6	8.4	216	10.6	13.3	335	10.5	20.4	3533	12.2	9.7
1991	1646	13.1	11.2	150	9.9	6.6	259	10.8	14.1	2055	12.6	11.3
1992[g]	598	13.1	9.0	34	11.1	2.9	87	10.4	6.6	719	12.7	8.4
1993	1528	13.8	15.3	113	13.4	18.2	166	13.0	34.2	1807	13.7	17.2
1994[e]	867	11.7	11.2	100	9.9	13.4	136	9.3	7.4	1104	11.3	10.9
1995	1121	13.8	21.2	256	10.9	10.6	258	11.3	15.8	1635	12.9	18.7

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.
[b] HCT, LKT, and KOK are believed to emigrate from Palisades Reservoir and numbers are directly related to extent of drawdown.
[c] Includes lake trout (LKT) and kokanee salmon (KOK).
[d] Electrofishing conducted in early November.
[e] Only two marking and no recapture runs done due to low flows.
[f] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.
[g] Only one marking and no recapture runs done due to low flows.

Appendix A-10. Range of flows, mean flow, and electrofishing sampling efficiencies (R/C) at the Conant section, South Fork Snake River, 1986-1995. Flows were recorded at the USGS Irwin gage. Electrofishing results are from MR4 database for all sizes of fish.

Sampling dates	Range of flows (cfs)	Mean flow (cfs)	WCT & HCT[a,b]				WRB & HYB[a]				BRN[a]				All[b,c]				Catch rate (fish/ day)[d]
			M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	M	C	R	R/C (%)	
1986: 11/ 4,5,6,7,20	3540-3780	3590	1171	546	70	13	32	17	2	12	186	107	8	7	1393	670	80	12	413
[e,f]1987: 11/5,6	869-941	905	299	--	--	--	6	--	--	--	43	--	--	--	348	--	--	--	174
1988: 10/ 3,4,11	3600-3710	3650	1101	567	98	17	41	18	1	6	115	48	4	8	1257	634	103	16	630
1989: 10/ 18,19,27	2990-3060	3040	1424	1067	200	19	58	55	10	18	107	79	11	14	1589	1201	221	18	930
1990: 10/ 11,12,18	3490-3690	3560	1768	1527	317	21	118	112	14	12	213	134	12	9	2102	1774	343	19	1292
1991: 10/ 7,8,15	4490-4790	4650	1159	627	140	22	105	54	9	17	158	120	19	16	1422	801	168	21	741
[e]1992: 10/14	--	2130	598	--	--	--	34	--	--	--	87	--	--	--	719	--	--	--	719
1993: 10/ 13,14,21, 22	2620-3820	3210	998	630	100	16	78	41	6	15	110	66	10	15	1186	737	116	16	481
[e]1994: 10/ 7,11,14	1220-2440	1850	867	--	--	--	100	--	--	--	136	--	--	--	1104	--	--	--	368
1995: 10/ 5,6,12,13	2570-4090	3290	633	565	77	14	130	143	17	12	154	117	13	11	917	825	107	13	436

Appendix A-10. Continued.

[a] WCT=wild cutthroat trout; HCT = hatchery cutthroat trout; WRB = wild rainbow trout; HYB = wild rainbow x cutthroat hybrid trout; BRN = wild brown trout.
[b] HCT, LKT, and KOK are believed to emigrate from Palisades Reservoir and numbers are directly related to extent of drawdown.
[c] Includes lake trout (LKT) and kokanee salmon (KOK).
[d] Includes recaptured fish; catch rate=(M+C)/number days sampled.
[e] No recapture runs due to low flows.
[f] Only 3.2 km of larger 4.9 km section was electrofished with drift boat.

Appendix A-11. Estimated abundance (N) of age 1 and older (∃ 4 in) wild and hatchery cutthroat trout at the Conant electrofishing section, South Fork Snake River, 1986-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	Ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
11/4/86	3.04	4.9	35.0	9021	14,161 (1005)	2967	4658	1841	2890	258	405	2.58	4.05
11/5/87	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/3/88	3.04	4.9	35.0	6249	7306 (370)	2056	2403	1275	1491	179	209	1.79	2.09
10/18/89	3.04	4.9	35.0	7403	7860 (269)	2435	2586	1511	1604	212	225	2.12	2.25
10/11/90	3.04	4.9	35.0	8304	11,416 (432)	2732	3755	1695	2330	237	326	2.37	3.26
10/7/91	3.04	4.9	35.0	5087	6854 (340)	1673	2255	1038	1399	145	196	1.45	1.96
10/14/92	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/13/93	3.04	4.9	35.0	6004	7364 (374)	1975	2422	1225	1503	172	210	1.72	2.10
10/7/94	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/5/95	3.04	4.9	35.0	4399	6029 (367)	1447	1983	898	1230	126	172	1.26	1.72

[a] No estimate; recapture runs not made.

Appendix A-12. Estimated abundance (N) of age 1 and older (∃ 4 in) wild rainbow and hybrid trout at the Conant electrofishing section, South Fork Snake River, 1986-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	Ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
11/4/86	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
11/5/87	3.04	4.9	35.0	---[b]	---	---	---	---	---	---	---	---	---
10/3/88	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/18/89	3.04	4.9	35.0	294	310 (65)	97	102	60	63	8	9	0.08	0.09
10/11/90	3.04	4.9	35.0	835	1004 (161)	275	330	170	205	24	29	0.24	0.29
10/7/91	3.04	4.9	35.0	544	657 (135)	179	216	111	134	16	19	0.16	0.19
10/14/92	3.04	4.9	35.0	---[b]	---	---	---	---	---	---	---	---	---
10/13/93	3.04	4.9	35.0	449	538 (127)	148	177	92	110	13	15	0.13	0.15
10/7/94	3.04	4.9	35.0	---[b]	---	---	---	---	---	---	---	---	---
10/5/95	3.04	4.9	35.0	1025	1326 (181)	337	436	209	271	29	38	0.29	0.38

[a] Unbiased estimate not possible as R <3 (Ricker 1975).
[b] No estimate; recapture runs not made.

Appendix A-13. Estimated abundance (N) of age 1 and older (∃ 6 in) wild brown trout at the Conant electrofishing section, South Fork Snake River, 1986-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
11/4/86	3.04	4.9	35.0	2166	3142 (632)	713	1034	442	641	62	90	0.62	0.90
11/5/87	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/3/88	3.04	4.9	35.0	1061	1652 (776)	349	543	217	337	30	47	0.30	0.47
10/18/89	3.04	4.9	35.0	596	936 (405)	196	308	122	191	17	27	0.17	0.27
10/11/90	3.04	4.9	35.0	1578	1806 (331)	519	594	322	369	45	52	0.45	0.52
10/7/91	3.04	4.9	35.0	905	954 (129)	298	314	185	195	26	27	0.26	0.27
10/14/92	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/13/93	3.04	4.9	35.0	602	663 (194)	198	218	123	135	17	19	0.17	0.19
10/7/94	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/5/95	3.04	4.9	35.0	1175	1442 (440)	387	474	240	294	34	41	0.34	0.41

[a] No estimate; recapture runs not made.

Appendix A-14. Estimated abundance (N) of all trout (∃4 in, including lake trout and kokanee salmon) at the Conant electrofishing section, South Fork Snake River, 1986-1995. Results are from MR4 database and analysis using modified Peterson (P) and log-likelihood (L) estimators. Standard deviations are in parentheses.

First marking date	Miles	km	ha	N/section		N/mile		N/km		N/ha		N/100 m^2	
				P	L	P	L	P	L	P	L	P	L
11/4/86	3.04	4.9	35.0	11,521	13,935 (608)	3,790	4,584	2,351	2,844	329	398	3.29	3.98
11/5/87	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/3/88	3.04	4.9	35.0	7,601	9005 (434)	2,500	2,962	1,551	1,838	217	257	2.17	2.57
10/18/89	3.04	4.9	35.0	8,427	8788 (262)	2,772	2,891	1,720	1,793	241	251	2.41	2.51
10/11/90	3.04	4.9	35.0	10,596	14,633 (435)	3,486	4,813	2,162	2,986	303	418	3.03	4.18
10/7/91	3.04	4.9	35.0	6,640	7920 (287)	2,184	2,605	1,355	1,616	190	226	1.90	2.26
10/14/92	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/13/93	3.04	4.9	35.0	7,215	8058 (324)	2,373	2,651	1,472	1,644	206	230	2.06	2.30
10/7/94	3.04	4.9	35.0	---[a]	---	---	---	---	---	---	---	---	---
10/5/95	3.04	4.9	35.0	6,785	8349 (391)	2,232	2,746	1,385	1,704	194	239	1.94	2.39

[a] No estimate; recapture runs not made.

Appendix A-15. Brown trout redd counts on the South Fork Snake River, 1979 to present.

Section	Distance (km)	12/11/79	12/16/80	12/4/81	12/8/82	12/20/83[a]	12/4/84	12/10/85	12/5/86	12/4/87[b]	12/5/88	12/18/89[c]	12/7/90	12/9/91	1992[d]	12/13/93	12/18/94	1995[e]
Afterbay of Palisades	0.8	50	61	69	90	49	75	179	294	70	199	117	168	111	---	40	56	---
Afterbay-Iwin	11.2	0	0	0	0	0	51	143	29	2	15	0	7	0	---	0	20	---
Irwin-Conant Valley	15.8	6	45	7	4	4	8	65	46	103	8	106	12	207	---	126	22	---
Conant-Burns Creek	16.2	89	104	95	120	96	37	143	311	133	216	215	171	216	---	55	109	---
Burns Creek-Anderson Diversion	20.6	14	23	0	57	9	51	8	62	47	39	61	127	141	---	88	53	---
Anderson-Heise Bridge	5.6	4	0	0	0	0	7	5	0	7	2	0	0	0	---	0	0	---
Heise Bridge-Mouth	30.4	2	5	21	NC	NC	23	65	67	168	66	75	81	214	---	115	46	---
TOTALS	100.6	177	251	216	271	154	252	608	809	530	545	574	566	889	---	424	306	---

[a] Counts should be considered low due to poor visibility from fog. NC = not counted.
[b] Later flights indicated fish spawned later in 1987 than in previous years. On December 14 in the afterbay, 105 redds were counted versus 70 on December 4.
[c] Late counts due to weather cancellations. Fog at dam, ice below Lorenzo.
[d] Not done in 1992 due to weather cancellations.
[e] Not done in 1995 due to unavailability of aircraft.

Appendix B. Otolith processing manual and data forms.

Otolith Processing Manual
by June Johnson
Sr. Fishery Technician
4/2/1996

Storage

Otoliths were stored in 3.7 ml vials. Glycerine and water, a 50:50 mix (enough to cover otoliths) were used to store the otoliths. It would be helpful to add several drops of alcohol to retard mold growth.

Labeling

Small pieces of write in the rain paper were labeled as follows and placed in the vials: species, total length, date collected, stream and section, otolith number (which referenced back to raw data in collection booklet), box number and vial number. Each vial number is unique and consecutive.

Surface aging

Otoliths were placed in a Petri dish in glycerine. Any oil seems to work ok. We tried wintergreen and clove oil, but glycerine seemed to work just as well. The groove (known as the sulcus) is placed down. Narrow rings were counted to determine age. I found it necessary to look closely, as the first ring was very light in some cases.

Magnification for surface aging

A Fisher Scientific Stereomaster II at power 1X was used to read otoliths. I placed a green piece of glass with a yellow filter over it over the bottom light source for the best results. I did not have any microscope lights on.

Cross sectioning otoliths

An otolith sectioning saw (Bromwill, no forwarding address), borrowed from the fish research facility at Nampa, is connected to a faucet and electricity. Water flies all over when cutting sections so prepare to get wet. Adjust water so it is running down the saw blade.

An epoxy resin (Epoxy patch kit quart system, EPK 0151-resin, batch #333041, Dexter Corp., Searbrook, N.H.)is mixed and placed in rubber molds. (We were unable to find a place to obtain more rubber molds.) The otolith is placed into the epoxy so there is epoxy on both sides, no air bubbles. The sulcus is placed horizontally and the otolith is placed in the tip of the mold. This is left to dry for 24 hours. It is essential to keep track of what vial's otolith are used in each mold. Number the molds and then keep track of the beginning and ending vial numbers and any vials whose otoliths you don't use. (see the form).

The next day the epoxy casts are numbered with the corresponding vial before they are removed. I label them with a permanent sharpie marker on both sides, just to be sure I know which one is which. Once the casts are ready and numbered, it's possible to begin cutting cross sections.

Method 1:
Place the epoxy cast into the vise on the saw. Line it up as best you can so you will cut slightly to the right of the focus. Cut until the cast is almost cut through. Stop forward motion and reverse the saw, turn it off. Use tweezers to break off the section and place is on a labeled glass microscope slide, or place it on a paper towel to dry, then onto the microscope slide. Make sure the slide is labeled with the vial/otolith number. Start the saw again and cut off the remaining small piece. If you don't the section won't toast properly.

Reverse the saw until the otolith and epoxy are clear of the blade. Turn the front dial on the saw 25 marks clockwise(notice the black marker lines) and cut another section. Repeat one more time so you have at least three sections (more is ok, depends on the size of the otolith). Keep the minnow net under the saw so if you cut too far your section will hopefully land in the net and not be washed away.

Method 2:
Place the epoxy cast into the vise on the saw. Line it up as best you can so you will cut slightly to the right of the focus. Cut all the way through and let the pieces fly into the net. Reverse saw until the cast is clear of the blade, move the dial 25 marks and put saw in forward motion to cut another section. If you use this method, you must watch carefully to salvage pieces that do not fly into the net before they are washed away. Keep the tweezers handy and of course stop motion and turn off the saw before you try to remove a cross section from the water. You must also bang the net on the trash can to empty it after you have removed the cross sections so different otolith sections are not mixed up. The reason for this is that it is sometimes difficult to see the cross-sectioned pieces in the net. It is imperative that you keep track of how many sections you have cut so you can try and retrieve them all.

Make sure the slide is labeled with the vial/otolith number. Once the sections are cut, place them on a paper towel to absorb some of the water, then onto a labeled microscope slide. Place on cooling rack to dry. Process other otoliths in the same manner.

Once the otoliths have been cut and placed on the slide it is time to darken them to make reading them easier. Once the sections and slides are dry, place the slide and sections on a Corning Hot Place, setting #4, for about a minute or until the otoliths turn dark brown. Remove slides and place on cooling rack.

Use liquid coverslip (Biomeda Crystal/Mount 1-800-341-8787, Forest City, California) to adhere the sections to the slide. I found that the sections tend to float in the liquid coverslip which makes it difficult to keep them lined up nicely. I used a two-step process where I made a small puddle of biomeda on each slide, dipped the sections into it then stuck them to the slide. Once this dried, I came back later and applied more to adhere them and put some over the otolith.

The otolith section will resemble a pair of lips. Read half the otolith (from the center out), counting the dark brown lines (light applied from the top). Count the bigger lines not tiny thin ones. I'm told these lines begin to fade after a week so it is best to read them right away.

Slides can be stored in a slide box from Fisher Scientific.

Appendix B. Continued.

Notes to improve the process

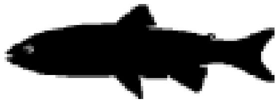
It is imperative that the saw blade is sharp and not bent. New blades were ordered from Freshmans Inc., Salt Lake City phone (801) 575-6316. The blade is 4" with a 1/2" arbor, Pro-Slicer, .012 in width. Cost was $24.50 in 1996. Compare this to another place that wanted over $200.00! These are jeweler's diamond edged saw blades.

It would be helpful if the saw tray were spray painted black so you could more easily find those pieces that fly, or if the epoxy were colored that might help solve the problem too.

If the hole in the tray where the water drains had a screen it would keep those few fly away sections from going down the drain.

It would be best to transport the saw with the blade removed.

Appendix B. Continued.



OTOLITH SAMPLING

Date ______________________

1

D1	C1	B1	A1
D2	C2	B2	A2
D3	C3	B3	A3
D4	C4	B4	A4
D5	C5	B5	A5
D6	C6	B6	A6

VIALS NOT USED

2

D1	C1	B1	A1
D2	C2	B2	A2
D3	C3	B3	A3
D4	C4	B4	A4
D5	C5	B5	A5
D6	C6	B6	A6

VIALS NOT USED

Appendix B. Continued.

Location ______	IDAHO DEPARTMENT OF FISH AND GAME					Year ______				
Card No. ______						Species ______				
	1	2	3	4	5	6	7	8	9	10
RIGHT										
LEFT										

Gum Card

SPECIES:______ DATE:______
TOTAL LENGTH:______ WEIGHT:______
COLLECTOR:______
WATER:______
REMARKS:

Scale Envelope

Appendix B. Continued.

WATER____________________ YEAR COLLECTED________

READER ____________

DATE READ ____________

CARD # ____________

SPECIES ____________

Idaho Department of Fish and Game
1515 Lincoln Road
Idaho Falls, ID 83401
(208) 525-7290

Computer Record #	Scale #	Date Collected	Length (mm)/	Weight (gm)	Age Scale	Otolith	Notes
	R1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	L1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						

Appendix C. Lab results of electrophoretic analysis.

The University of
Montana

Division of Biological Sciences
Missoula, Montana 59812-1002
(406) 243-5122
FAX (406) 243-4184

February 15, 1996

Bill Schrader
Idaho Fish & Game
1515 Lincoln Road
Idaho Falls, Idaho 83401-2198

Bill:

The electrophoretic analysis of the trout sample collected from the Conant electrofishing section on the South Fork of the Snake River (N=60, 10/12-13/95) has been completed. Horizontal starch gel electrophoresis was used to determine each fish's genetic characteristics at 45 loci (genes) coding for proteins present in eye, liver, or muscle tissue (Table 1). At some of these loci, the Yellowstone cutthroat trout, *Oncorhynchus clarki bouvieri*, rarely shares alleles (form of a gene) in common with rainbow trout, *O. mykiss* (Table 2). These loci are generally termed diagnostic loci because the alleles detected at them can be used to determine the genetic status of a population. That is, whether a sample came from a genetically pure population of one of these fishes, or one where hybridization has or is occurring.

Of the 60 fish selected for analysis by your department, 20 were identified in the field as Yellowstone cutthroat trout, 20 as rainbow trout, and 20 as hybrids between these fishes. Protein resolution of tissues from these trout, however, indicated that 23 were pure Yellowstone cutthroat trout, 27 were pure rainbow trout, and 10 were hybrids (Table 3). Thus, 14 of the 60 fish analyzed, or 23.3%, were incorrectly identified in the field. Of those misidentified, nine or 33% of the rainbow trout in the sample were identified as hybrids, three or 13% of the Yellowstone cutthroat trout in the sample were identified as hybrids, and two or 20% of the hybrids in the sample, were identified as pure rainbow trout.

Sincerely,

George K. Sage

George K. Sage

Appendix C. Continued.

Table 1

Enzymes and loci examined. Tissues: E = eye, L = liver, M = muscle.

Enzyme	Loci	Tissue
Adenylate kinase	AK-1*, AK-2*	M
Alcohol dehydrogenase	ADH*	L
Aspartate aminotransferase	sAAT-1*, sAAT-2* sAAT-3,4*	L M
Creatine Kinase	CK-A1*, CK-A2* CK-B*, CK-C1*, CK-C2*	M E
Dipeptidase	PEPA-1*, PEPA-2*	E
Glucose-6-phosphate isomerase	GPI-A*, GPI-B1*, GPI-B2*	M
Glyceraldehyde-3-phosphate dehydrogenase	GAPDH-3*, GAPDH-4*	E
Glycerol-3-phosphate dehydrogenase	G3PDH-1*, G3PDH-2*	L
Isocitrate dehydrogenase	mIDHP-1*, mIDHP-2* sIDHP-1*, sIDHP-2*	M E
L-Iditol dehydrogenase	IDDH*	L
L-Lactate dehydrogenase	LDH-A1*, LDH-A2* LDH-B1*, LDH-B2*, LDH-C*	M E
Malate dehydrogenase	sMDH-A1,2* sMDH-B1,2*	L M
Malic enzyme	mMEP-1*, mMEP-2*, sMEP-1* sMEP-2*	M L
Phosphoglucomutase	PGM-1*, PGM-2*	M
Phosphogluconate dehydrogenase	PGDH*	M
Superoxide dismutase	sSOD-1*	L
Tripeptide aminopeptidase	PEPB*	E
Xanthine dehydrogenase-like	XDH1	L

Note: In Yellowstone cutthroat trout, some pairs of loci produce a protein with identical function and electrophoretic mobility. For example, sAAT-3* and sAAT-4* both produce an aspartate aminotransferase in muscle tissue. The proteins produced from the common alleles at these loci occupy the same position in the gels after electrophoresis. Such pairs of loci are commonly termed isoloci and their existence can be confirmed only when one or both loci are genetically variable. In such situations, however, it is not possible to determine at which locus of the pair a variant allele exists. In order to estimate allele frequencies at the isoloci in Yellowstone cutthroat trout populations (sAAT-3,4*, sMDH-A1,2*, sMDH-B1,2*), therefore, each pair was considered to be a single gene with four instead of two copies per individual.

Table 2

Diagnostic loci between Yellowstone cutthroat trout and rainbow trout. When more than one allele exists at a locus within a taxon, the most common allele is listed first.

Locus	Characteristic alleles	
	Yellowstone	Rainbow
sAAT-1*	165	100, 0
CK-A2*	84	100
CK-C1*	38	100, 38
mIDHP-1*	-75	100
sMEP-2*	110	100, 75
PEPB*	135	100, 135

Table 3

Genetic status of each fish at the diagnostic loci used to distinguish Yellowstone cutthroat and rainbow trout. The last two columns indicate the field and gel identification of each fish.

	Diagnostic Loci							
Fish #	sAAT-1	CK-A2	CK-C1	mIDHP-1	sMEP-2	PEP-B	Field I.D.	Gel I.D.
Con-1	YS	YS	YS	YS	YS	YS	YS	YS
Con-2	YS	YS	YS	YS	YS	YS	YS	YS
Con-3	RT	RT	RT	RT	RT	RT	RT	RT
Con-4	RT	RT	RT	RT	RT	RT	RT	RT
Con-5	RT	RT	RT	YS/RT	YS/RT	RT	HYBRID	HYBRID
Con-6	RT	RT	RT	RT	RT	RT	RT	RT
Con-7	RT	RT	RT	RT	RT	RT	RT	RT
Con-8	YS	YS	YS	YS	YS	YS	YS	YS
Con-9	RT	RT	RT	RT	RT	RT	RT	RT
Con-10	YS/RT	RT	RT	RT	YS/RT	YS/RT	RT	HYBRID
Con-11	RT	RT	RT	YS/RT	RT	RT	HYBRID	HYBRID
Con-12	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-13	RT	RT	RT	RT	RT	RT	RT	RT
Con-14	YS	YS	YS	YS	YS	YS	YS	YS
Con-15	YS	YS	YS	YS	YS	YS	HYBRID	YS
Con-16	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-17	RT	RT	RT	RT	RT	RT	RT	RT
Con-18	YS	YS	YS	YS	YS	YS	YS	YS
Con-19	RT	RT	RT	RT	RT	RT	RT	RT
Con-20	RT	RT	RT	RT	YS/RT	RT	RT	HYBRID
Con-21	RT	RT	RT	RT	RT	RT	RT	RT
Con-22	RT	RT	RT	RT	RT	RT	RT	RT
Con-23	RT	RT	RT	RT	RT	RT	RT	RT
Con-24	YS	YS	YS	YS	YS	YS	YS	YS
Con-25	RT	RT	RT	RT	RT	RT	RT	RT
Con-26	RT	RT	RT	RT	RT	RT	RT	RT
Con-27	YS/RT	RT	YS/RT	RT	RT	RT	HYBRID	HYBRID
Con-28	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-29	RT	RT	RT	RT	RT	RT	RT	RT
Con-30	RT	RT	RT	RT	RT	RT	RT	RT

Table 3 - continued

Fish #	sAAT-1	CK-A2	CK-C1	mIDHP-1	sMEP-2	PEP-B	Field I.D.	Gel I.D.
	Diagnostic Loci							
Con-31	YS	YS	YS	YS	YS	YS	YS	YS
Con-32	RT	RT	RT	RT	RT	RT	RT	RT
Con-33	RT	RT	RT	RT	RT	RT	RT	RT
Con-34	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-35	YS	RT	YS	RT	YS	YS	HYBRID	HYBRID
Con-36	YS	YS	YS	YS	YS	YS	HYBRID	YS
Con-37	RT	RT	RT	RT	RT	RT	RT	RT
Con-38	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-39	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	HYBRID	HYBRID
Con-40	YS	YS	YS	YS	YS	YS	YS	YS
Con-41	YS	YS	YS	YS	YS	YS	YS	YS
Con-42	YS	YS	YS	YS	YS	YS	YS	YS
Con-43	YS	YS	YS	YS	YS	YS	YS	YS
Con-44	YS	YS	YS	YS	YS	YS	YS	YS
Con-45	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	HYBRID	HYBRID
Con-46	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	HYBRID	HYBRID
Con-47	YS	YS	YS	YS	YS	YS	HYBRID	YS
Con-48	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-49	YS	YS	YS	YS	YS	YS	YS	YS
Con-50	YS	YS	YS	YS	YS	YS	YS	YS
Con-51	YS	YS	YS	YS	YS	YS	YS	YS
Con-52	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	YS/RT	HYBRID	HYBRID
Con-53	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-54	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-55	RT	RT	RT	RT	RT	RT	HYBRID	RT
Con-56	YS	YS	YS	YS	YS	YS	YS	YS
Con-57	YS	YS	YS	YS	YS	YS	YS	YS
Con-58	YS	YS	YS	YS	YS	YS	YS	YS
Con-59	YS	YS	YS	YS	YS	YS	YS	YS
Con-60	YS	YS	YS	YS	YS	YS	YS	YS

Appendix D. Lab results of whirling disease analysis.

JAN 0 9 1996

FISH HEALTH INSPECTION REPORT

EAGLE FISH HEALTH LABORATORY
208-939-2413
208-939-2415 (fax)

Accession(s) 95-512

Investigator(s) Blanck, Scott

Inspection Date: 10-27-95

Date Results Communicated:

Report Type: Final X

Final Pending____ Est Date ____

Contact Person/Station

Bill Shrader/Upper Snake Reg.

Purpose: Inspection / / Certification / / Wild Fish /X/ Research / /

Lab Exam Procedure(s) (X = work reported here: P = pending work)

Bacteriology____ EIBS____ ELISA ____ FAT (BKD)____ FAT (viro)____

Hematology____ Histopathology____ Mycology____ Necropsy____

Parasitology____ Virology____ Whirling Disease X Other

INSPECTION RESULTS Pathogens Associated With Following Diseases(no+/no.spec.)

Fish per pool

Accession	Year	Stock/Species	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WD	CS	Other
95-512	Wild	SF Snake Lorenzo/ Whitefish								0/75		

SIGNIFICANCE	Pathogen	Drug Resist. ( )	Prevalence (no./total) Carrier	Clinical Signs	Epizootic
Class A					
Class B					
Class C					

RECOMMENDATIONS/COMMENTS:

No spores detected in digest of 75 fish. Tissues (not examined histologically) will be held for future reference.

Present Station Disease Classification:

12-27-95
Date of Issue

[signature]
Signature of Fish Health Official

Appendix D. Continued.

FISH HEALTH INSPECTION REPORT

EAGLE FISH HEALTH LABORATORY
208-939-2413
208-939-2415 (fax)

Accession(s) 95-513

Investigator(s) Hauck, Hoage

Inspection Date: 10-27-95

Date Results Communicated:

Report Type: Final X

Final Pending_____ Est Date _____

Contact Person/Station

Bill Shinder / Upper Snake Reg.

Purpose: Inspection / / Certification / / Wild Fish / X / Research / /

Lab Exam Procedure(s) (X = work reported here: P = pending work)

Bacteriology_____ EIBS_____ ELISA _____ FAT (BKD)_____ FAT (viro)_____
Hematology_____ Histopathology_____ Mycology_____ Necropsy_____
Parasitology_____ Virology_____ Whirling Disease X Other

INSPECTION RESULTS: Pathogens Associated With Following Diseases (no+/no. spec.)

Fish per pool

Accession	Year	Stock/Species	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WD	CS	Other
95-513	Wild	SF Snake - Lorenzo / Brn. Trt.								0/65		

SIGNIFICANCE	Pathogen	Drug Resist. ( )	Prevalence (no./total) Carrier	Clinical Signs	Epizootic
Class A					
Class B					
Class C					

RECOMMENDATIONS/COMMENTS:

Spores undetected in digest. Histo not conducted. Tissues will be held for future reference (histo) as needed.

Present Station Disease Classification:

12-21-95
Date of Issue

Anzf
Signature of Fish Health Official

JAN 2 3 1996

FISH HEALTH INSPECTION REPORT

EAGLE FISH HEALTH LABORATORY
208-939-2413
208-939-2415 (fax)

Accession(s) 95-513 addendum
Investigator(s) Munson, Hogge, Ukura
Inspection Date: 10-10-95
Date Results Communicated:

Contact Person/Station
Bill Shrader/Upper Snake Reg.

Report Type: Final X
Final Pending ____ Est Date ____

Purpose: Inspection / / Certification / / Wild Fish / X / Research / /

Lab Exam Procedure(s) (X = work reported here: P = pending work)
Bacteriology____ EIBS____ ELISA ____ FAT (BKD)____ FAT (viro)____
Hematology____ Histopathology X Mycology____ Necropsy____
Parasitology Virology Whirling Disease X Other

INSPECTION RESULTS Pathogens Associated With Following Diseases(no+/no.spec.)

Fish per pool												
Accession	Year	Stock/Species	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WD	CS	Other
95-513	Wild	SF Snake: Lorenzo / Brown Trt								0/65		

SIGNIFICANCE	Pathogen	Drug Resist.( )	Prevalence (no./total) Carrier	Clinical Signs	Epizootic
Class A					
Class B					
Class C					

RECOMMENDATIONS/COMMENTS: No pathogens detected.

Kent Hauck did not find any trophozoites, but cartilage damage suggested Myxobolus activity. The fish in these waters should be examined again at a later date.

Present Station Disease Classification:

1-22-96
Date of Issue

Signature of Fish Health Official

Appendix D. Continued.

APR 0 8 1996

EAGLE FISH HEALTH LABORATORY

208 - 9393-2413
208 - 939-2415 FAX

FISH HEALTH INSPECTION REPORT

ACCESSION(S) 95-514
Investigator(s) K.HAUCK
HOGGE,SCOTT
Inspection Date 9/19/95
Date Results Communicated: ______

Contact Person	Station	Report Type: Final: X
B.SCHRADER	/ 6 UPPER SNAKE REGION	Final pending: ______ Est Date ______

Purpose: (INSP, DIAG, CERT, WILD FISH, RESEARCH) WILD FISH Region 6 UPPER SNAKE

Lab Exam Procedure(s) (X= work reported here P= pending work)

Bacteriology ____ EIBS ____ ELISA ____ FAT(BKD) ____ FAT(Viro) ____ Hematology ____ Histopathology X
Mycology ____ Necropsy ____ Parasitology ____ Virology ____ Whirling Disease X Other ____

INSPECTION RESULT Pathogens Associated With Following Diseases (no + / no. spec.)

Accession	BroodYear	Stock / Species (Fish per pool)	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WHD	CSH	OTHER
95-514	WILD	S. SNAKE PALISADES RESERV / CUTTHROAT TROUT SECTION								0/67		

SIGNIFICANCE	PATHOGEN	DRUG RESISTANT ( )	PREVALENCE NO. / TOTAL CARRIER	CLINICAL SIGNS	EPIZOOTIC
Class A					
Class B					
Class C					

Final Diagnosis/Comments: No pathogens detected. Myxobolus found in digestion, but not in histo.

RECOMMENDATIONS/COMMENTS:

Present Station Disease Classification:

4/2/96
Date of Issue

Signature of Fish Health Official

FISH HEALTH INSPECTION REPORT

EAGLE FISH HEALTH LABORATORY
208-939-2413
208-939-2415 (fax)

Accession(s) 95-515
Investigator(s) Burton, Scott, Wavra
Inspection Date: 9
Date Results Communicated:
Report Type: Final X
Final Pending____ Est Date ____

Contact Person/Station
Bill Shrader / Upper Snake Region

Purpose: Inspection / / Certification / / Wild Fish / X / Research / /

Lab Exam Procedure(s) (X = work reported here: P = pending work)
Bacteriology____ EIBS____ ELISA ____ FAT (BKD)____ FAT (viro)____
Hematology____ Histopathology X Mycology____ Necropsy____
Parasitology Virology Whirling Disease X Other

INSPECTION RESULTS Pathogens Associated With Following Diseases (no+/no. spec.)
Fish per pool

Accession	Year	Stock/Species	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WD	CS	Other
95-515	Wild	S.F. Snake- Pallisades Section / Rainbow trout								5/14	pools	(?)

SIGNIFICANCE	Pathogen	Drug Resist. ( )	Carrier	Clinical Signs	Epizootic
Class A					
Class B	Myxobolus cerebralis	N/A		✓	
Class C					

RECOMMENDATIONS/COMMENTS: Spores found by digestion in 5 of 14 pools. Confirmed by Histology in ramified cartilage.

Present Station Disease Classification:

3-1-96
Date of Issue

Douglas R. Burton
Signature of Fish Health Official

FISH HEALTH INSPECTION REPORT

EAGLE FISH HEALTH LABORATORY
208-939-2413
208-939-2415 (fax)

Accession(s) 95-517, 95-522, 95-529
Investigator(s) Hauck, Scott, Hogge
Inspection Date: 8-24, 1-3
Date Results Communicated:
Report Type: Final X
Final Pending_____ Est Date _____

Contact Person/Station
B. Shrader/Upper Snake Reg.

Purpose: Inspection / / Certification / / Wild Fish / / Research / /

Lab Exam Procedure(s) (X = work reported here: P = pending work)
Bacteriology_____ EIBS_____ ELISA _____ FAT (BKD)_____ FAT (viro)_____
Hematology_____ Histopathology X Mycology_____ Necropsy_____
Parasitology Virology Whirling Disease X Other

INSPECTION RESULTS Pathogens Associated With Following Diseases (no+/no.spec.)

Fish per pool

Accession	Year	Stock/Species	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WD	CS	Other
95-517		SOUTH FORK RNBT X CUTT								0/53		
95-522		TETON RIVER BKT		Histo [illegible] not [illegible]; [illegible]						0/22	+/5	Digest
95-529		ANTELOPE CREEK BKT								0/7		

SIGNIFICANCE	Pathogen	Drug Resist. ( )	Prevalence (no./total) Carrier	Clinical Signs	Epizootic
Class A					
Class B					
Class C					

RECOMMENDATIONS/COMMENTS: No ~~pathogens detected~~

Myxobolus spp. found in digest of 95-517 & 95-522 but not confirmed in histo.

Present Station Disease Classification:

1-5-96
Date of Issue

Signature of Fish Health Official

FISH HEALTH INSPECTION REPORT

EAGLE FISH HEALTH LABORATORY
208 - 9393-2413
208 - 939-2415 FAX

ACCESSION(S) 95-518
Investigator(s) K.HAUCK
WAVRA
Inspection Date 9/19/95
Date Results Communicated:
Report Type: Final: X
Final pending: ____ Est Date ____

Contact Person: B.SHRADER
Station: 6 UPPER SNAKE REGION

Purpose: (INSP, DIAG, CERT, WILD FISH, RESEARCH) WILD FISH Region 6 UPPER SNAKE

Lab Exam Procedure(s) (X= work reported here P= pending work)
Bacteriology ____ EIBS ____ ELISA ____ FAT(BKD) ____ FAT(Viro) ____ Hematology ____ Histopathology ____
Mycology ____ Necropsy ____ Parasitology ____ Virology ____ Whirling Disease ✓ Other ____

INSPECTION RESULT Pathogens Associated With Following Diseases (no + / no. spec.)

Accession	BroodYr	Stock / Species (Fish per pool)	IHN	IPN	EIBS	BKD	FUR	ERM	CWD	WHD	CSH	OTHER
95-518	WILD	S.F. SNAKE RIVER / MOUNTAIN WHITEFISH										
		(Palisades section)								0/53		*

SIGNIFICANCE	PATHOGEN	DRUG RESISTANT ( )	PREVALENCE NO. / TOTAL: CARRIER	CLINICAL SIGNS	EPIZOOTIC
Class A					
Class B					
Class C	Henneguya sp	NA	✓		

Final Report Diagnosis/Comments: No Myxobolus spores detected by digestion
Henneguya in 1/11 pools

RECOMMENDATIONS/COMMENTS:

Present Station Disease Classification:

4/10/96
Date of Issue

Douglas R. Burton
Signature of Fish Health Official

1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-20

Project I: Surveys and Inventories

Subproject I-G: Upper Snake Region

Job: c^2

Title: Rivers and Streams Investigations- Henrys Fork Snake River, Little Lost River, Big Lost River

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

An intensive on-the-water creel survey on the Henrys Fork Snake River above Island Park Reservoir produced a total fishing pressure estimate of 27,346 hours for the opening day through the Labor Day weekend period. This stretch of river continues to rate as one of the most heavily fished stream reaches in Idaho at 836 angler h/ha. The estimated catch rate of 0.8 fish/h was identical to that reported in the last intensive survey on this reach (1988). Hatchery catchable rainbow trout *Oncorhynchus mykiss* provided the majority of the fishing followed by brook trout *Salvelinus fontinalis*. Wild rainbow trout were insignificant in the catch. Angler satisfaction was good.

An electrofishing population survey on the Box Canyon Reach of the Henrys Fork resulted in an estimated population size of 5,900 (2.0/100 m^2) wild rainbow trout over 6 inches (150 mm) in length. This represents a continued decline in numbers since the population spike of fall 1993 which resulted from large numbers of reservoir fish entering the river when the reservoir was drained and renovated in fall 1992.

Whirling disease sampling throughout the region detected presence of the disease organism in at least one salmonid species in all drainages checked except the Henrys Fork above Mesa Falls.

Authors:

Bruce A. Rich
Regional Fishery Biologist

Mark Gamblin
Regional Fishery Manager

OBJECTIVES

1. Evaluate the put and take fishery in the Henrys Fork Snake River above Island Park Reservoir.

2. Estimate the population size and size structure of the wild rainbow trout *Oncorhynchus mykiss* population (>6 in) in the Box Canyon reach of the Henrys Fork.

3. Determine presence or absence of the whirling disease organism *Myxobolus cerebralis* in salmonids in the Henrys Fork Snake River, Little Lost River, and Big Lost River drainages.

METHODS

Henrys Fork Snake River

Mack's Inn Creel Survey

An intensive creel survey was conducted on this reach from the Memorial Day opening weekend through Labor Day weekend to better understand this fishery and resource. A canoe was used to float from the water-trail put-in down to Upper Coffee Pot Campground below Mack's Inn. Counts and interviews were done simultaneously as the creel clerk floated the entire reach once in a typical survey day. The entire survey was stratified into three sections (Figure 1), and data were analyzed using the Idaho Department of Fish and Game (IDFG) creel program (McArthur 1993).

Box Canyon Electrofishing

We electrofished this reach in the third (marking effort) and fourth (recapture effort) weeks of May. Two drift boat shockers were used simultaneously on marking and recapture runs. One boat shocked the left bank and one shocked the right bank on the first (morning) run. Then one boat shocked the left side of the remaining river channel and another the right during the second (afternoon) run. A total of 18 and 8 boat passes were made on the mark and recapture runs, respectively.

Little Lost River

A sampling crew from the U.S. Forest Service (USFS) Lost River Ranger District conducted a comprehensive survey (USFS and IDFG co-funded) of perennial streams in the Little Lost River watershed. Backpack electrofishers were used to sample for species presence/absence, community composition, length frequency, and sometimes fish density.

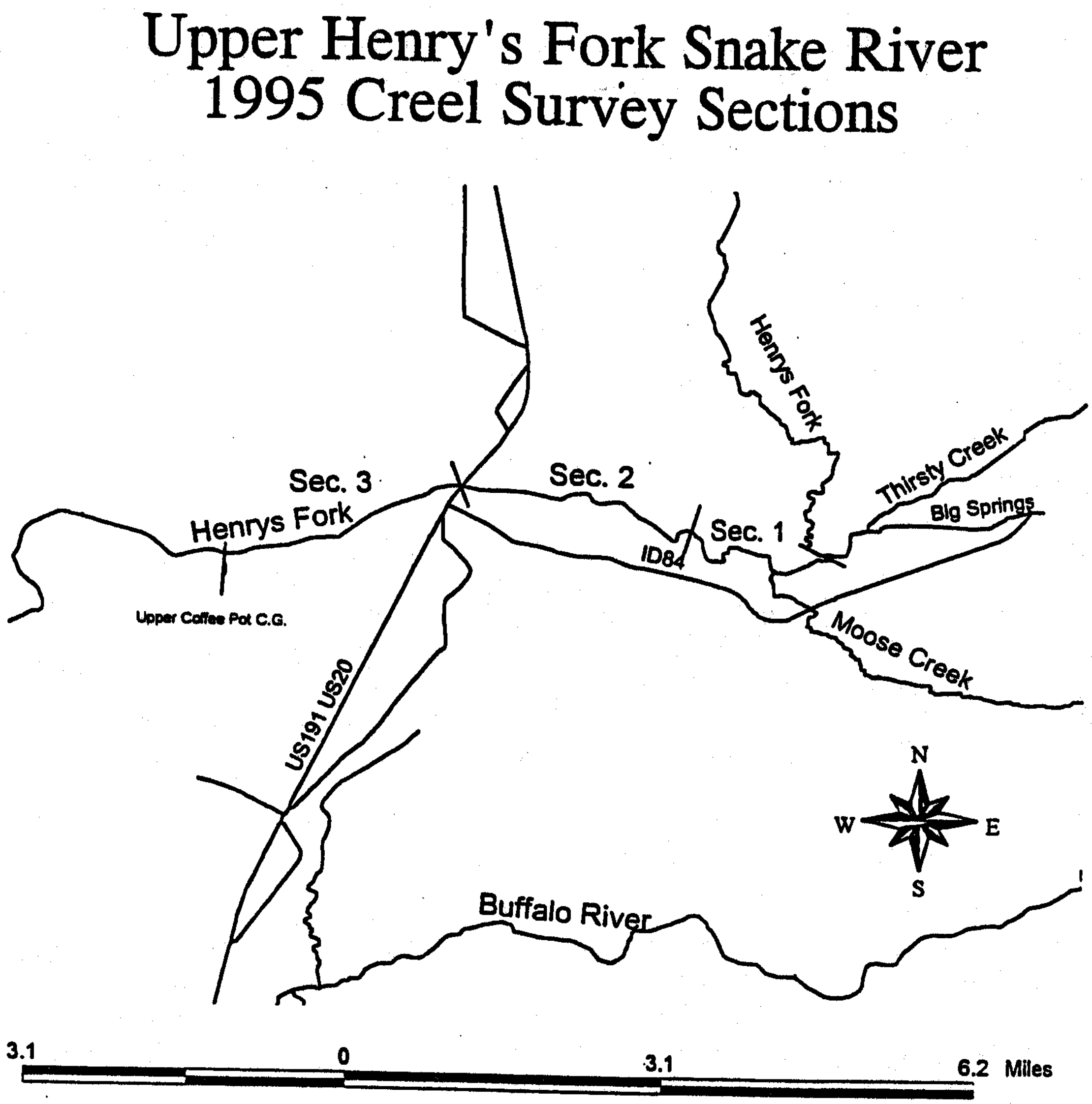


Figure 1. Creel survey sections in the Upper Henrys Fork Snake River, summer, 1995.

Whirling Disease Sampling

Gamefish from a variety of Upper Snake Region waters were captured by electrofishing and sent to the Eagle Fish Health Lab to be examined for presence of the whirling disease parasite *Myxobolus cerebralis*. A variety of sizes and species of salmonids were collected in the Henrys Fork Snake River (winter), Little Lost River and Big Lost River (summer) drainages. Obtaining a variety of sizes (especially juveniles) of rainbow trout was the objective, but that proved difficult. Each salmonid of any size encountered was eventually collected. Laboratory analysis was by microscopic visual inspection with confirmation by histopathology.

RESULTS AND DISCUSSION

Henrys Fork Snake River

Mack's Inn Creel Survey

Angling effort on this reach was 27,346 hours (836 h/ha; Table 1). This is among the highest in the state for a river or stream (Schill 1992), and is especially notable for a general regulation water. Angling pressure has remained virtually unchanged from that observed in the 1977 and 1988 creel surveys. The 1988 creel survey was conducted at the time the regulations below Island Park Dam went to catch and release, and the 1977 survey was well before initiation of catch and release regulations on the majority of the Henrys Fork in Island Park.

We agree with Elle and Corsi (1994) that proximity to Yellowstone National Park and associated tourist traffic contribute to fishing pressure on the Henrys Fork. In addition, nonresident property owners and their guests contribute significantly to the effort in this reach of the Henrys Fork.

The total catch rate, harvest rate, and release rate in 1995 were about the same as 1988 but well below the estimates for 1977 (Coon 1978; Tables 1 and 2). It is possible that catch rates from 1977 were overestimated and/or that wild rainbow and brook trout *Salvelinus fontinalis* contributed more to the catch then than they did in the two more recent survey years.

Angling pressure by fishing method varied among all three survey sections; boat, bank, and wading were the most popular methods in sections 1, 2 and 3, respectively (Table 3). Lures, bait, and flies were the popular terminal tackle types in sections 1, 2 and 3, respectively (Appendix A-1).

Few wild rainbow were kept in the catch (Tables 2 and 4). The opinion of a vocal segment of the angling public is that wild rainbow are overharvested by anglers attracted to this reach by high-density stockings of hatchery fish. In fact, in 1995, very few rainbow trout were harvested even at small sizes.

The reach is known to actually have only mediocre growth for wild rainbow trout. Also, the reach probably has lower recruitment rates now than previously when spawning and rearing habitat was more fully seeded by spawners from Island Park Reservoir.

Table 1. Estimated angling effort and catch rates on the upper Henrys Fork Snake River, 1977, 1988 and 1995. All surveys were conducted from the Memorial Day opener through Labor Day weekend on the same river reach.

	Creel survey year		
	1977[a]	1988[b]	1995
Total effort (h)	29,011	25,675	27,346
Effort/area (h/ha)	887	785	836
Catch rate (fish/h)	2.0	.08	0.8
Harvest rate (fish/h)	0.6	0.4	0.3

[a] Coon, 1978.
[b] Elle and Corsi, 1994.

Table 2. Estimated catch rates (CR, fish/h) of game fish on the upper Henrys Fork Snake River, 1995.

Estimates	Section 1	Section 2	Section 3	Reach/season total
CR kept	0.14	0.35	0.25	0.25
CR released	0.34	0.40	0.78	0.51
CR caught	0.48	0.76	1.03	0.75
Hatchery rainbow trout	0.30	0.64	0.64	0.52
Wild rainbow trout	0.03	0	0	0.01
Brook trout	0.13	0.07	0.19	0.14
Mountain whitefish	0.01	0	0	0

Table 3. Estimated angling pressure (h) by fishing method, upper Henrys Fork Snake River, 1995.

	Section 1	Section 2	Section 3	Total
All	10,399	10,658	6,289	27,346
Boat	7,649	2,524	378	10,551
Bank	1,195	4,312	530	6,037
Float tube	113	0	0	113
Wade	1,442	3,822	5,382	10,646

Table 4. Estimated numbers of game fish caught, kept, and released on the upper Henrys Fork Snake River, 1995.

	Section 1	Section 2	Section 3	Total
Fish kept	1,282	4,559	1,230	7,071
Fish released	2,913	5,642	5,894	14,449
Fish caught	4,199	10,201	7,126	21,526
Hatchery rainbow trout	383	3,795	950	5,128
Wild rainbow trout	89	0	47	136
Brook trout	739	394	121	1,254
Mountain whitefish	0	47	84	131

Brook trout length frequency distributions varied by river section (Appendix A-2). Harvested brook trout size was largest near the Henrys Lake outlet and decreased in size (along with numbers) toward Upper Coffee Pot Campground. This could be due to at least two factors: the effect of Henrys Lake and its outlet as a source of these fish, and heavy harvest rates proceeding downstream which may significantly reduce survival of sizeable individuals migrating downstream. We have observed large numbers of juvenile brook trout in this reach while electrofishing.

Angler satisfaction was generally good on this reach in 1995. Of anglers who were asked, "How would you rate your fishing today?" 57% responded fair, good or excellent (Table 5). Likewise, 71% of anglers who were asked "How would you rate the fishing on this reach of river overall?" responded with fair, good or excellent (Table 6).

Box Canyon Electrofishing

A total of 1,669 trout were sampled in May 1995. Species composition and relative abundance were wild rainbow trout (95%), hatchery rainbow trout (<1%), cutthroat trout (<1%), hybrid rainbow X cutthroat trout (2%), and brook trout (2%).

Wild rainbow trout sampled in this reach ranged in size from <1 to 24 in (<25 to 610 mm TL; Appendix B). The length frequency distribution is skewed from the normal for fish populations due to a larger mode of adults (up to and including those of trophy size) than young-of-year and or yearlings. This could be due to several factors: 1) the higher sampling efficiencies for larger fish, 2) limited in-river recruitment, and 3) the strong attraction of this reach for adults with an impassable dam at its upper terminus.

Estimated abundance of wild rainbow trout (∃6 in or 152 mm) was 6,080 fish using the modified Peterson method and 5,904 fish using the log-likelihood method (Table 7). These estimates equate to 2.1 or 2.0 fish/100 m^2 (2,533 or 2,460 fish per river mile). For comparison with past years, we report the log-likelihood method estimate for consistency and best probable degree of accuracy. The 1995 estimate, while higher than the record low years of 1989 and 1991, continues the decline documented from 1993 to 1994 (Figure 2; Table 7). This decline would be expected if the fall 1993 estimate was comprised of a large number of fish flushed from the reservoir in the 1992 drawdown and salvage operation.

This reach of river, while having high potential to produce rainbow trout, is recruitment limited. The fact that the population has declined steadily since the influx of reservoir fish in 1992 is further evidence of this problem. Adding the Buffalo River to the spawning and rearing habitat available to Henrys Fork spawners has the best potential to restore this reach of the Henrys Fork to its former potential in terms of numbers and size of wild rainbow trout.

Further analysis is needed on the time series population estimates to ensure that sampling and analysis methods used in all years were uniform or that standardization can be applied if methods varied.

Little Lost River

Results of 1995 sampling, integrated with all data previously collected in the Little Lost River drainage, will be presented in a separate report.

Table 5. 1995 upper Henrys Fork Snake River angler responses by river section to the question, "How would you rate your fishing today?"

	Section 1 (n=58)	Section 2 (n=127)	Section 3 (n=54)	Total (n=239)
Excellent	9	7	13	9
Good	17	32	28	27
Fair	19	20	26	21
Poor	50	36	26	37
No opinion	5	5	7	5

Table 6. 1995 upper Henrys Fork Snake River angler responses by river section to the question, "How would you rate the fishing on this reach of river overall (relative to other waters)?"

	Section 1 (n=58)	Section 2 (n=127)	Section 3 (n=54)	Total (n=239)
Excellent	16	24	35	24
Good	36	36	30	35
Fair	19	10	9	12
Poor	5	2	4	3
No opinion	24	28	22	26

Table 7. Estimated abundance of wild rainbow trout ($\geq$6 in or 152 mm) in the Box Canyon section, Henrys Fork Snake River, 1993-1995.

	Modified Peterson method (MPM)	Log-likelihood method (LLM)	Sample section length (mi)	Entire reach length (mi)	#/river mile by MPM (LLM)	#/reach by MPM (LLM)
Box Canyon Fall 1993	~10,000		2.4	2.8	~4,200	11,800
Box Canyon Spring 1994	7,234	9,359	2.4	2.8	3,014 (3,900)	8,439 (10,920)
Box Canyon Spring 1995	6,080	5,904	2.4	2.8	2,533 (2,460)	7,092 (6,888)

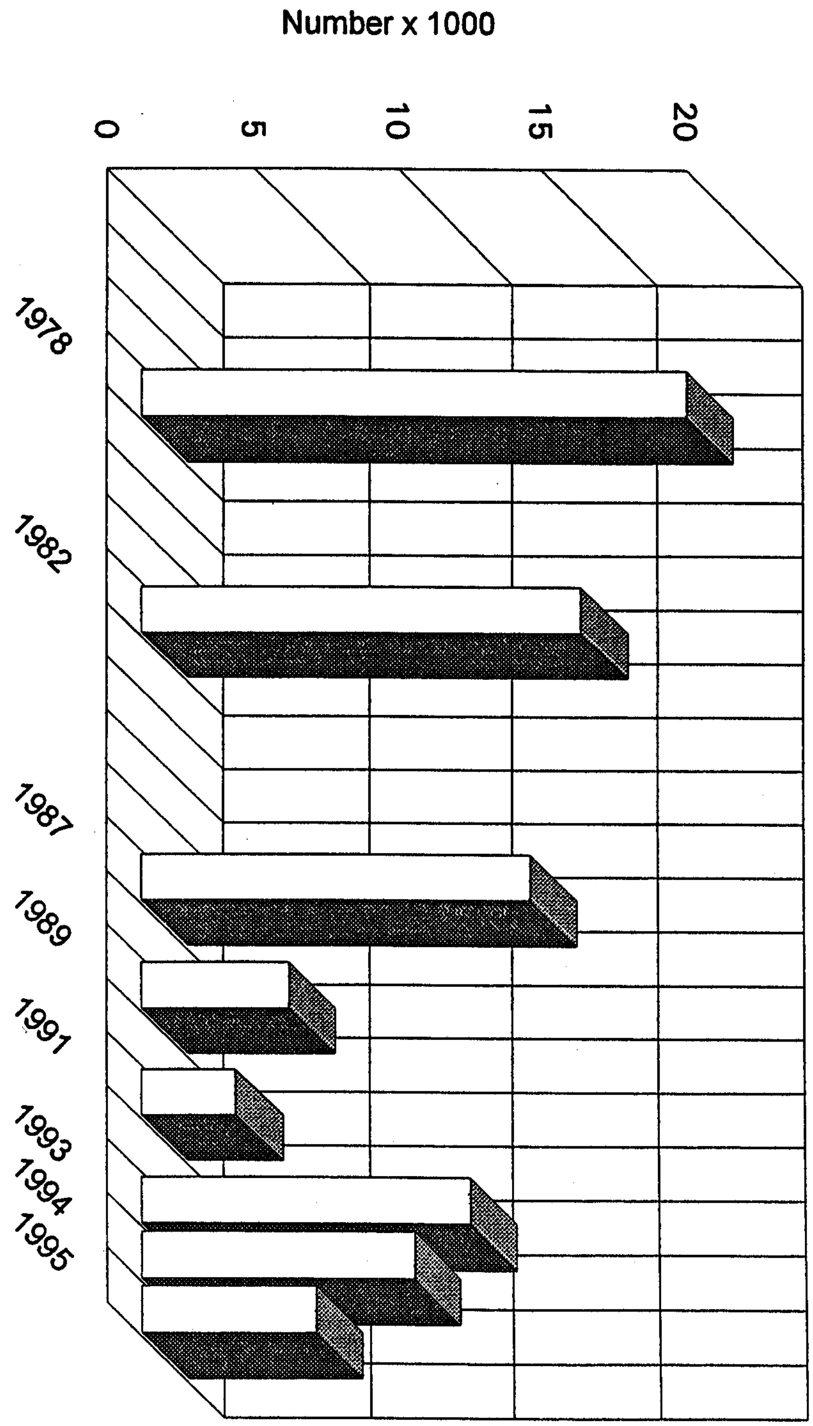


Figure 2. Estimated abundance of wild rainbow trout (≥6 in or 152 mm) in the Box Canyon section, Henrys Fork Snake River, 1978-1995.

Whirling Disease Sampling

Most sample sites tested positively for the whirling disease organism (in at least one salmonid species) except the Henrys Fork above Mesa Falls at Last Chance (Table 8). We will try to resample that site in 1996, focusing on YOY juveniles mid-summer to early fall when they have had a chance to pick up the organism but not succumb to the disease.

Table 8. Summary of whirling disease pathology for samples collected in late 1994 and all of 1995 (+ denotes confirmed *Myxobolus cerebralis*; - denotes no confirmation).

	Wild rainbow trout	Brook trout	Mountain whitefish	Kokanee
Little Lost River	+			
Summit Creek	-	-		
Sawmill Creek	+	-		
Wet Creek	+			
Antelope Creek		+		
Cherry Creek		+		
Horsethief Creek		-		
Big Lost River	-			
Mackay Reservoir				+
East Fork Big Lost	+	+	-	
Starhope Creek		-		
Henrys Fork Snake River at Last Chance	-	-		

RECOMMENDATIONS

1. Continue spring estimates of wild rainbow trout in the Box Canyon reach of the Henrys Fork Snake River.

2. Initiate creel surveys on the Box Canyon and Buffalo rivers in 1996 at levels similar to that used on the Upper Henrys Fork in 1995.

3. Initiate a watershed level electrofishing survey effort in the Big Lost River similar to the 1995 Little Lost River survey.

4. Resample for whirling disease in the same or similar locations as in 1995 but with a new protocol. Sample for juvenile trout in the critical stage between infection and death. Also, laboratory analysis of these samples should determine spore "loading" density if possible, a parameter not measured in analysis of the 1995 samples.

5. Continue to actively pursue upstream fish passage on the Buffalo River to provide recruitment of rainbow trout to the Henrys Fork Snake River below Island Park Dam.

ACKNOWLEDGMENTS

We thank Bart Gamett and helpers, Mike Foster, and Matt Mitro who were pivotal in collection of the aforementioned data.

LITERATURE CITED

Coon, J.C. 1978. Henrys Fork fisheries investigations. Idaho Department of Fish and Game, Boise.

Elle, S., and C. Corsi. 1994. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Job Performance Report. Project F-71-R-13, Boise.

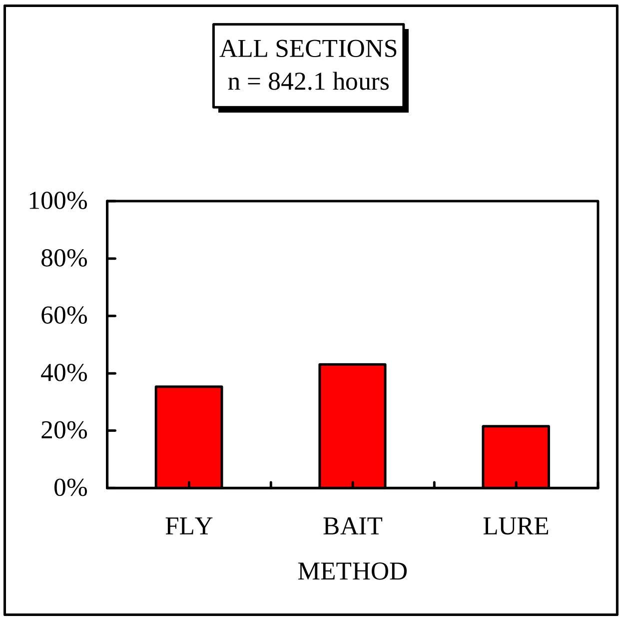
McArthur, T.J. 1993. Statewide angler opinion and harvest surveys - creel census system. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Job Completion Report. Project F-73-R-15, Subproject I, Study I, Job 2, Boise.

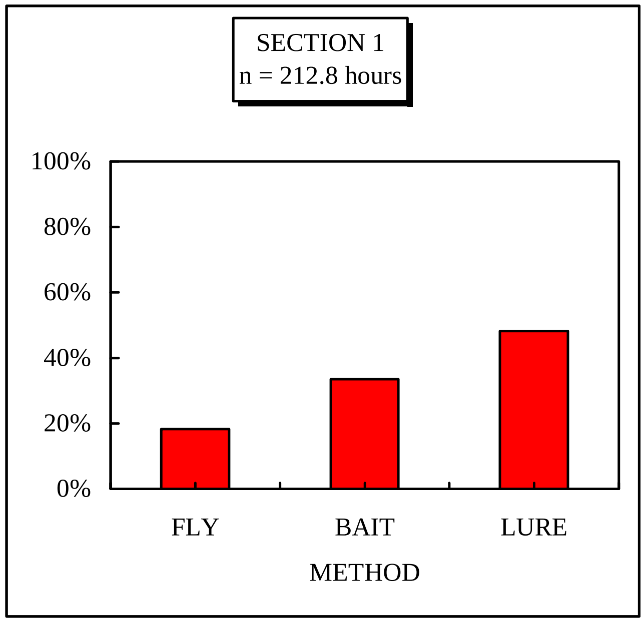
Schill, D.J. 1992. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Job Performance Report. Project F-71-R-13, Subproject II, Study IV, Boise.

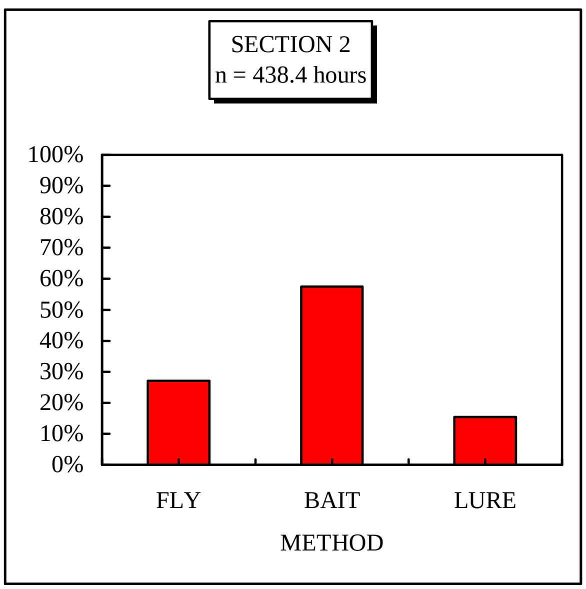
APPENDICES

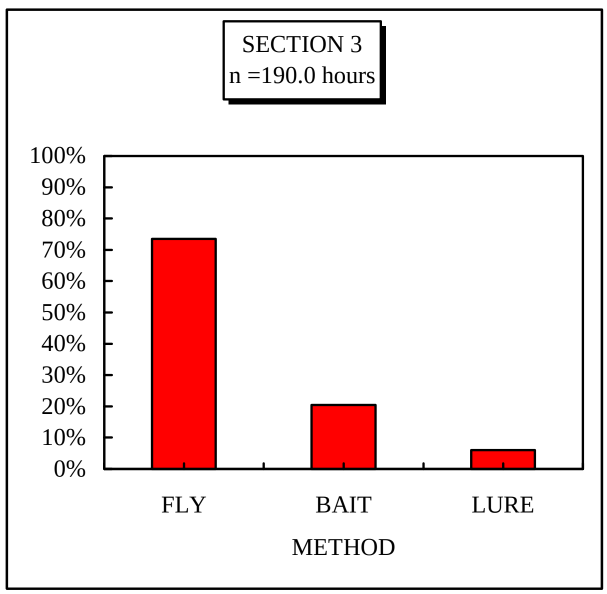
Appendix A. Upper Henrys Fork Snake River (Mack's Inn) creel survey results, 1995.

Appendix A-1. Percent utilization of fly, bait and lure fishing methods by upper Henrys Fork anglers, 1995.

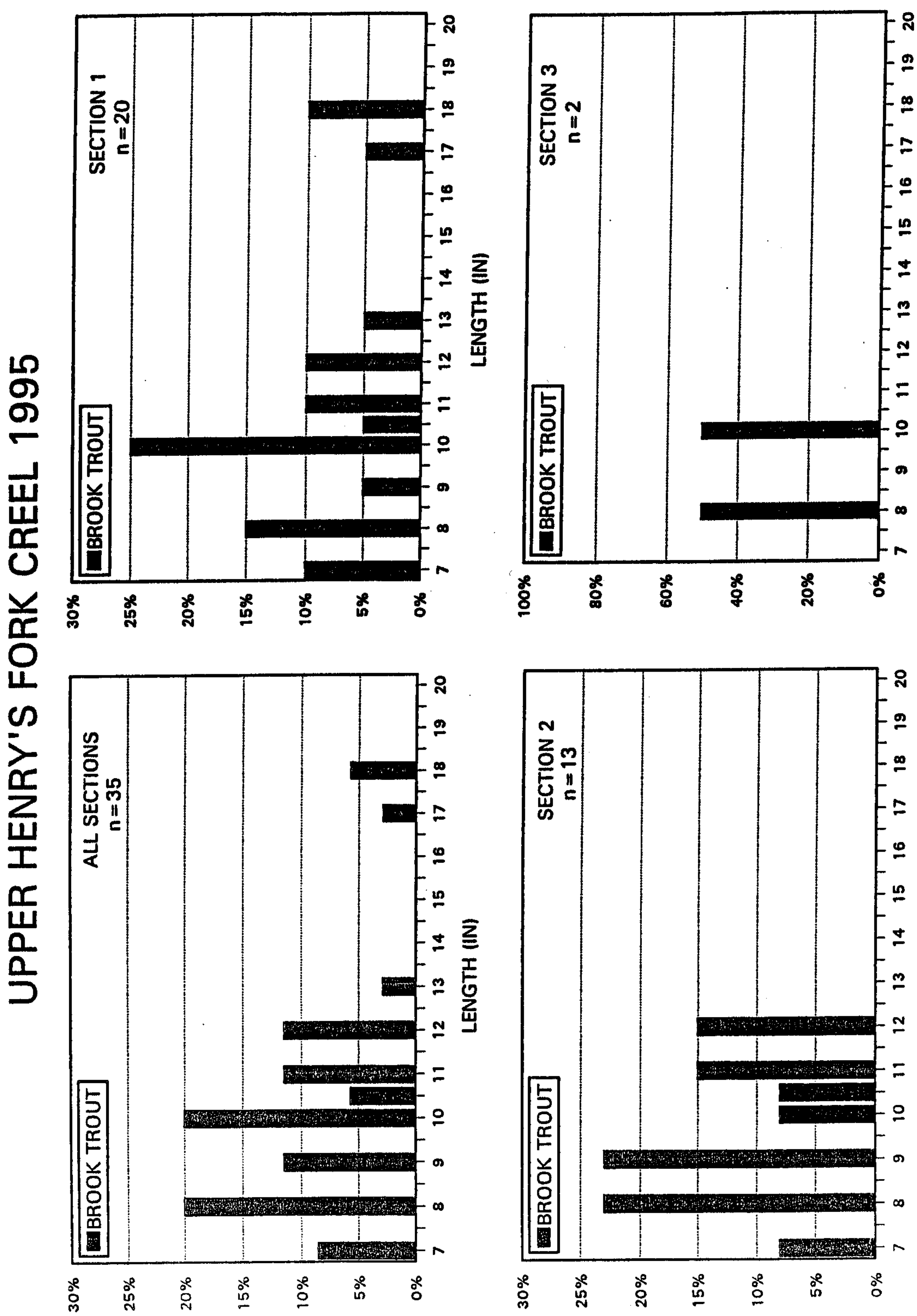




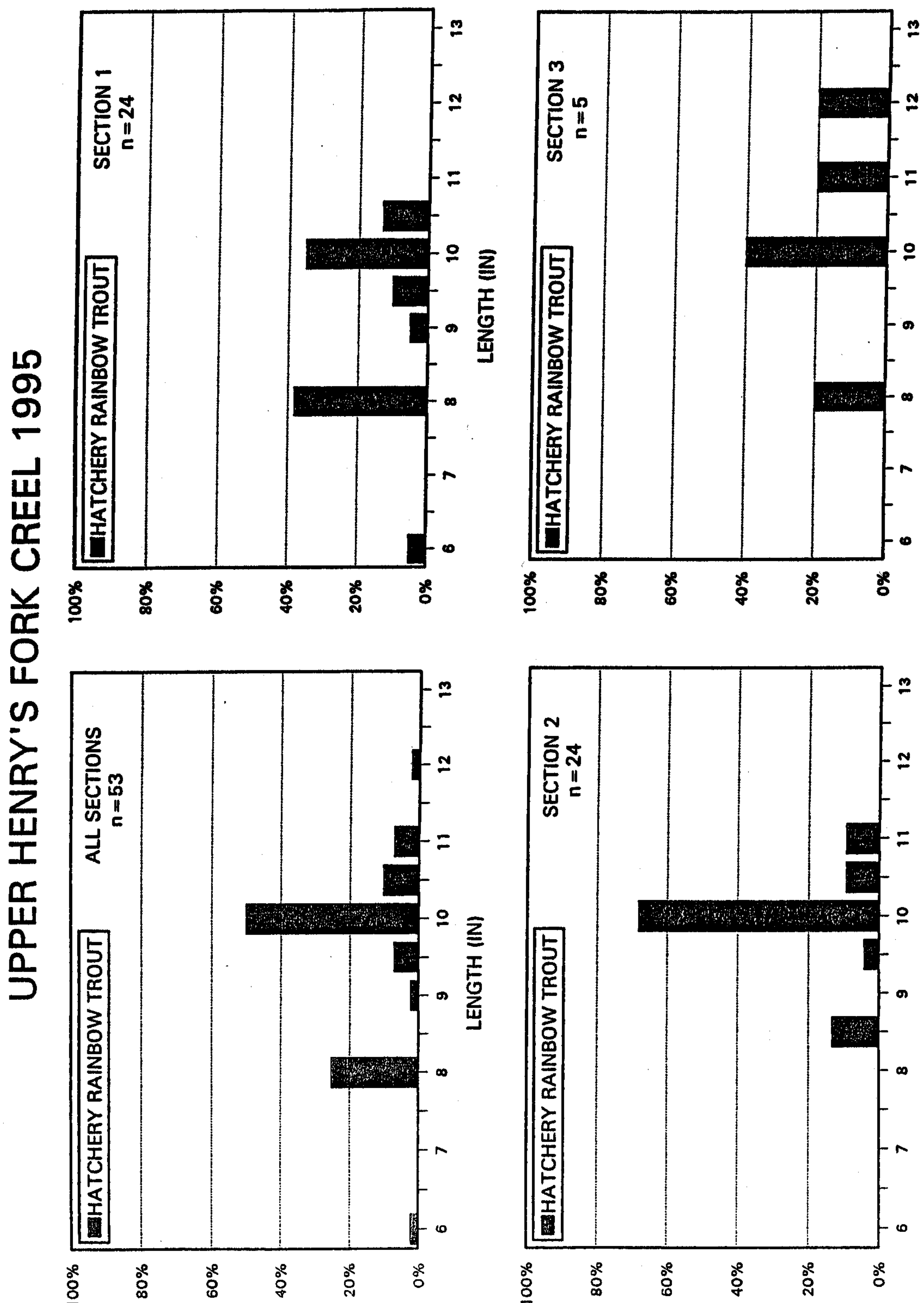




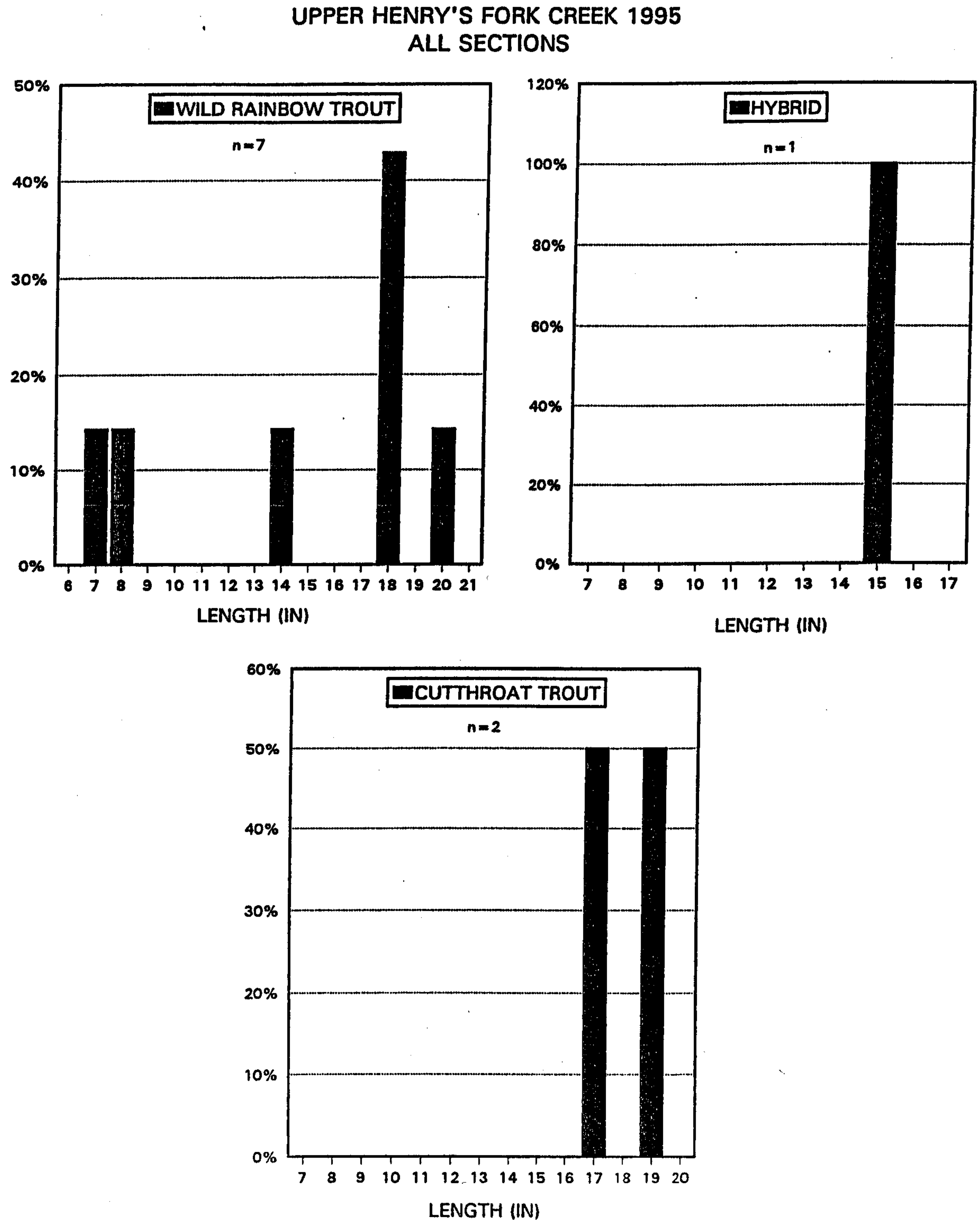
Appendix A-2. Length frequency distribution of brook trout by section and for all sections at the upper Henrys Fork, 1995.



Appendix A-3. Length frequencies of hatchery rainbow trout harvested from the upper Henrys Fork, 1995.

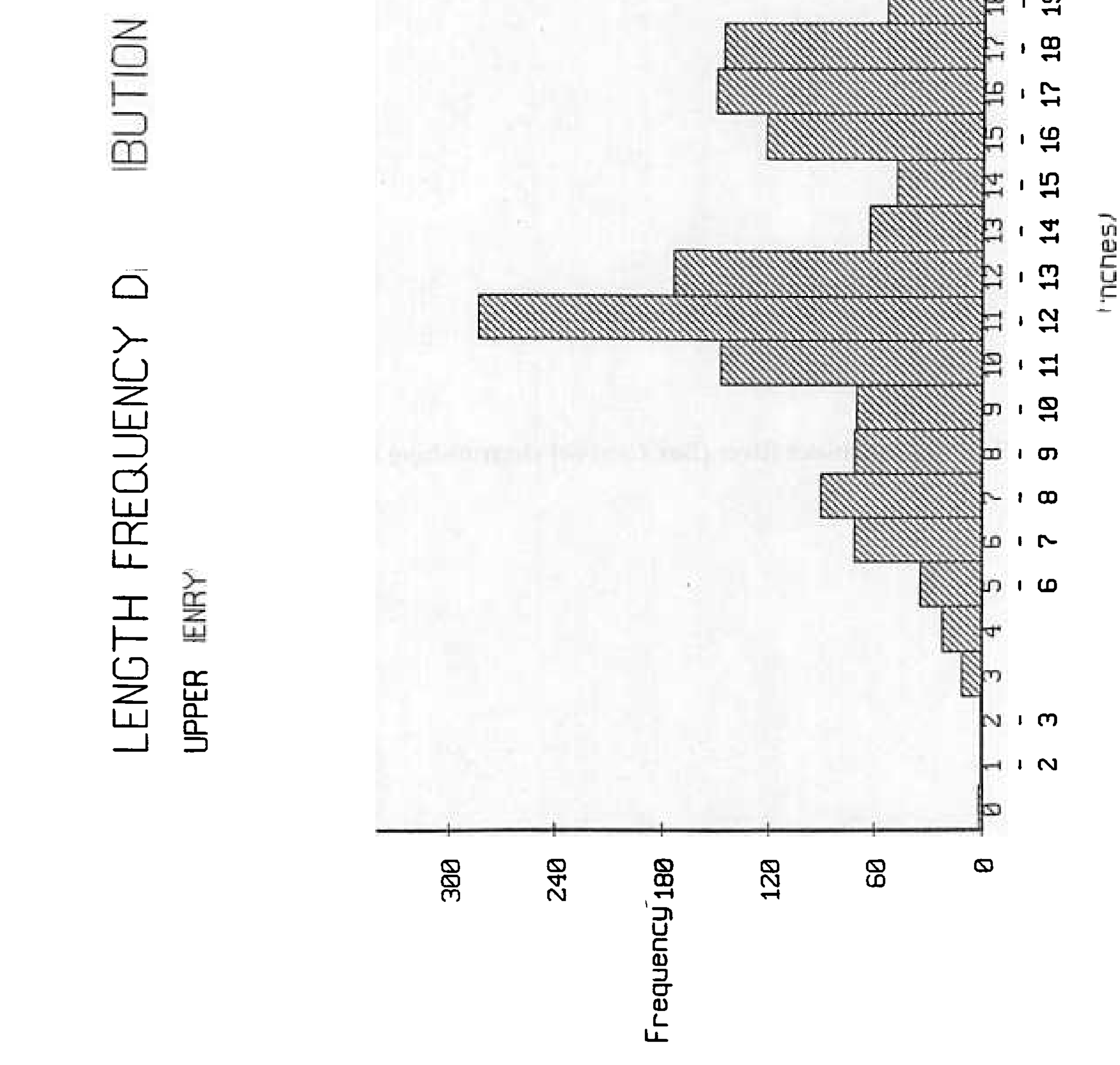


Appendix A-4. Length frequency of wild rainbow, hybrid and cutthroat trout harvested from the upper Henrys Fork Snake River, 1995.



Appendix B. Henrys Fork Snake River (Box Canyon) electrofishing results, May 1995.

Continued.



LENGTH FREQUENCY D
IBUTION
UPPER IENRY
Frequency
0
60
120
180
240
300
0
1
2
3
4
5
6
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10
11
12
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14
15
16
17
18
19
20
21
24
2 - 3
6 - 7
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10 - 11
12 - 13
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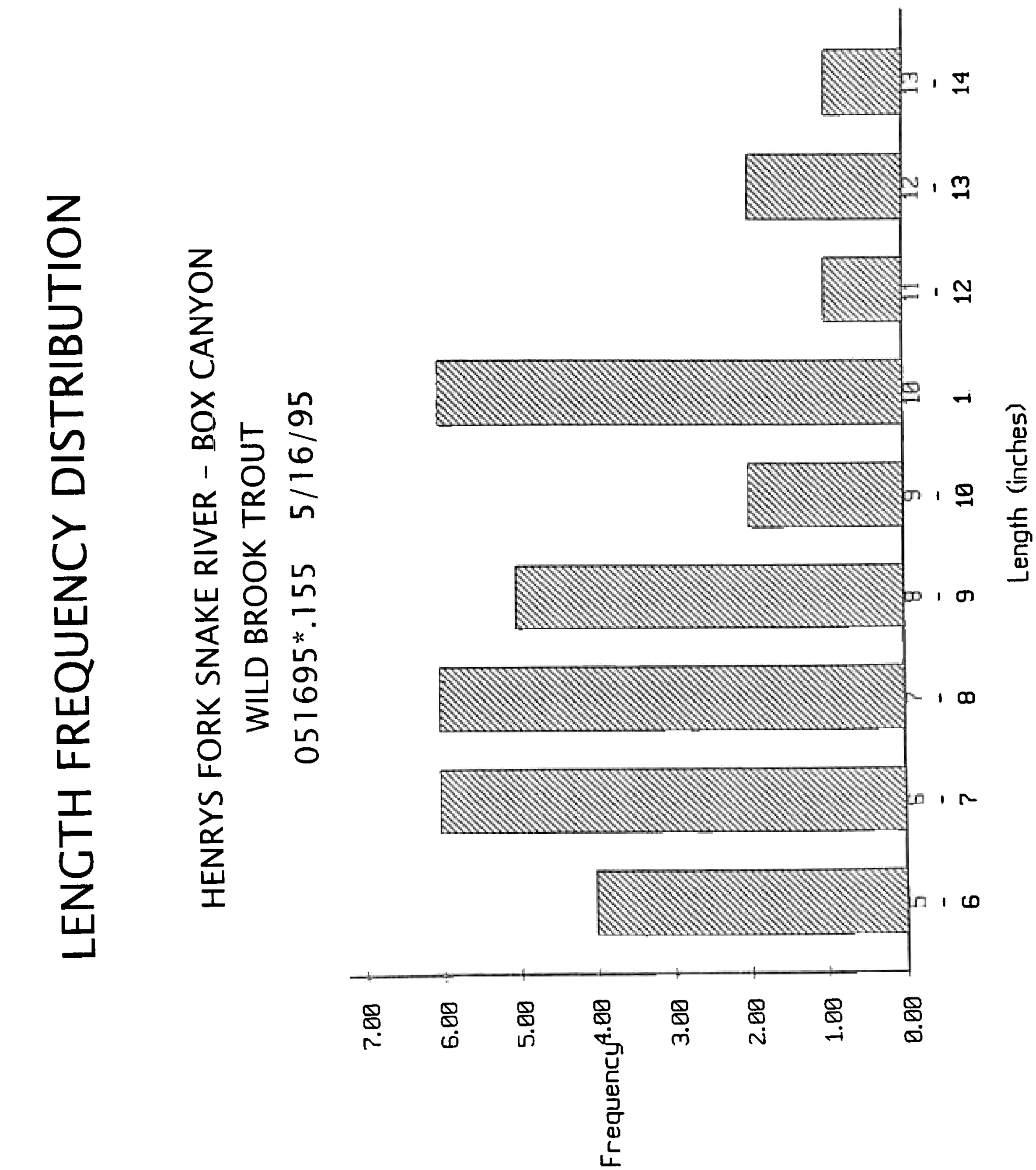
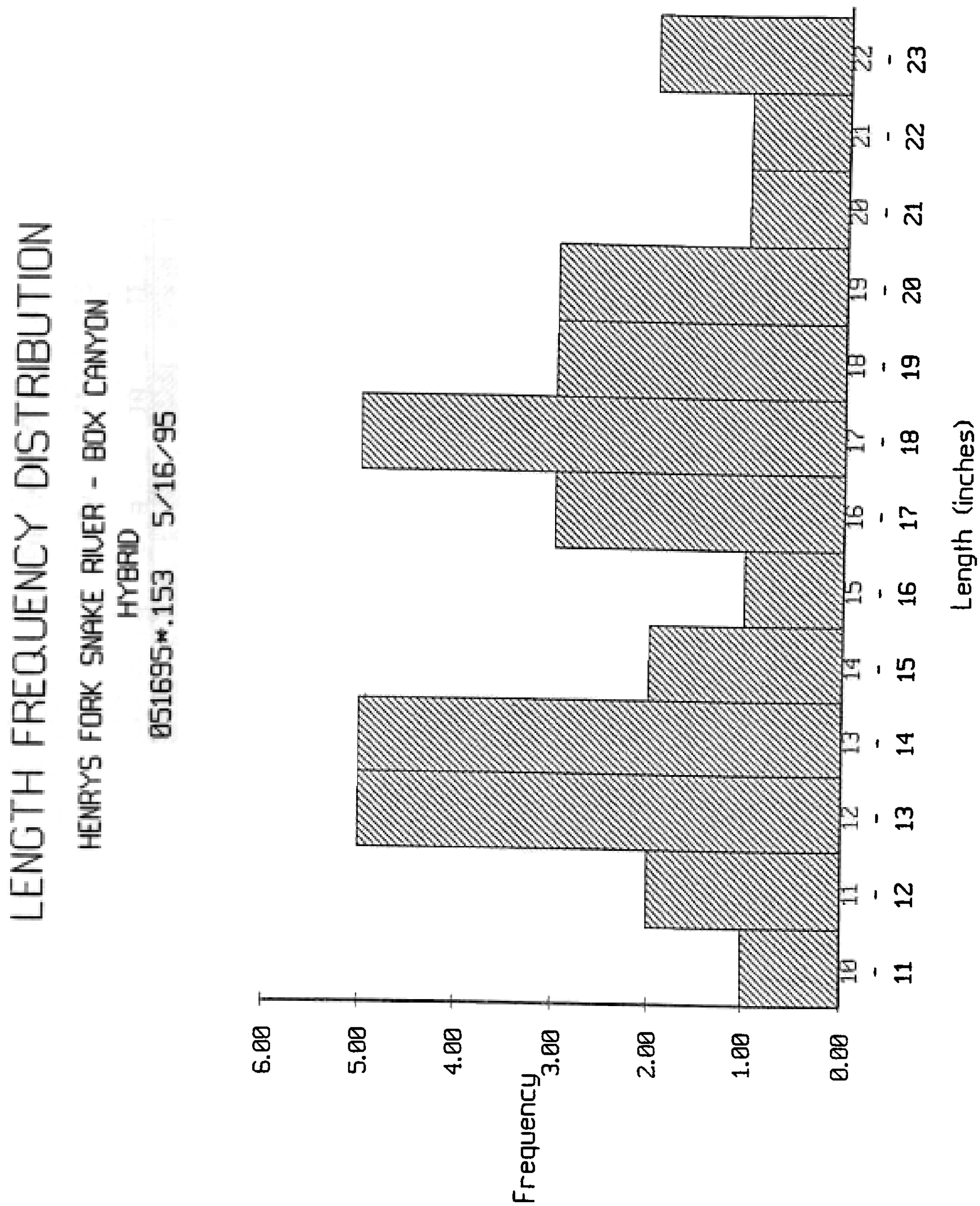
16 - 17
18 - 19
20 - 21
22 - 25
'nches)

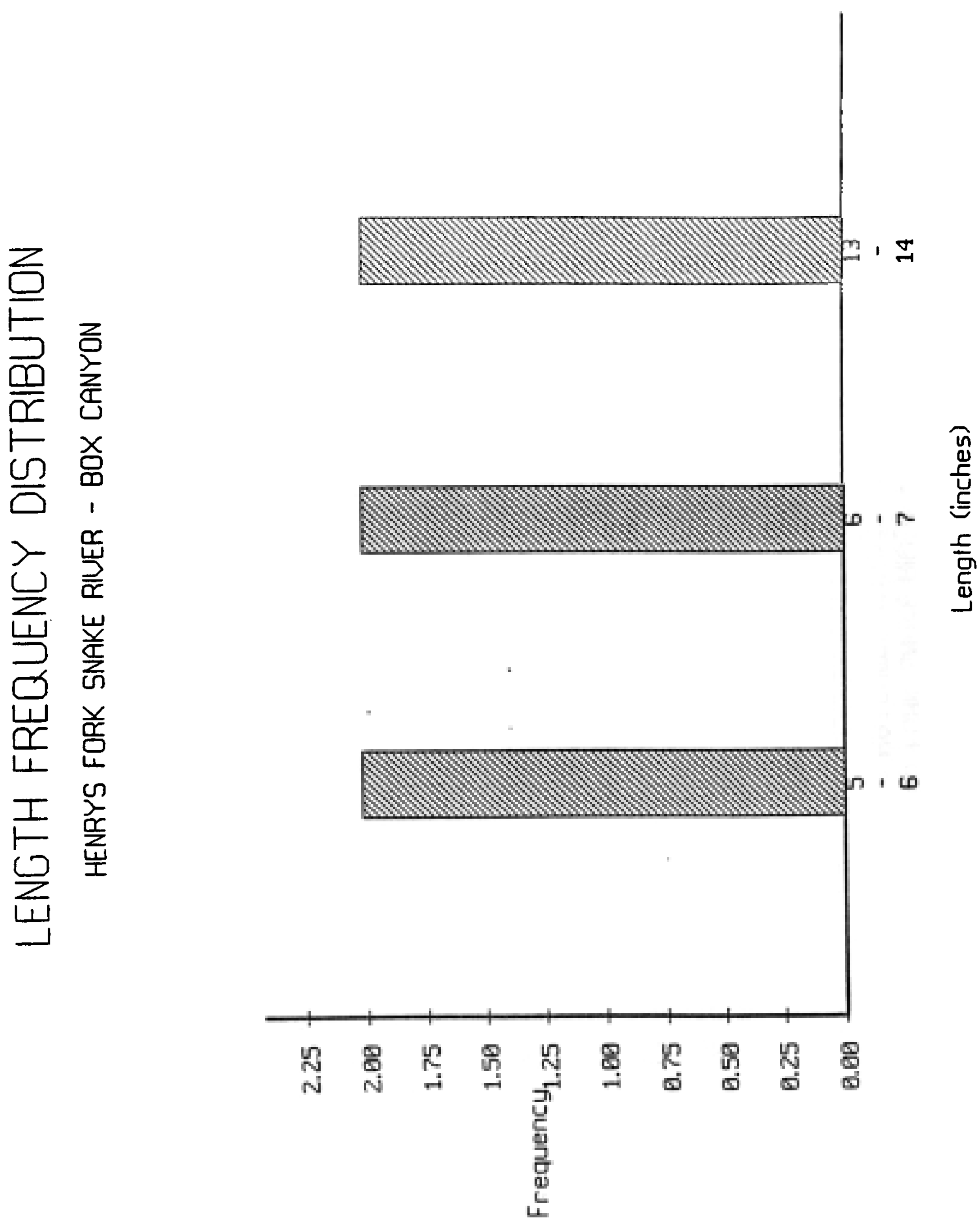
Appendix B. Continued



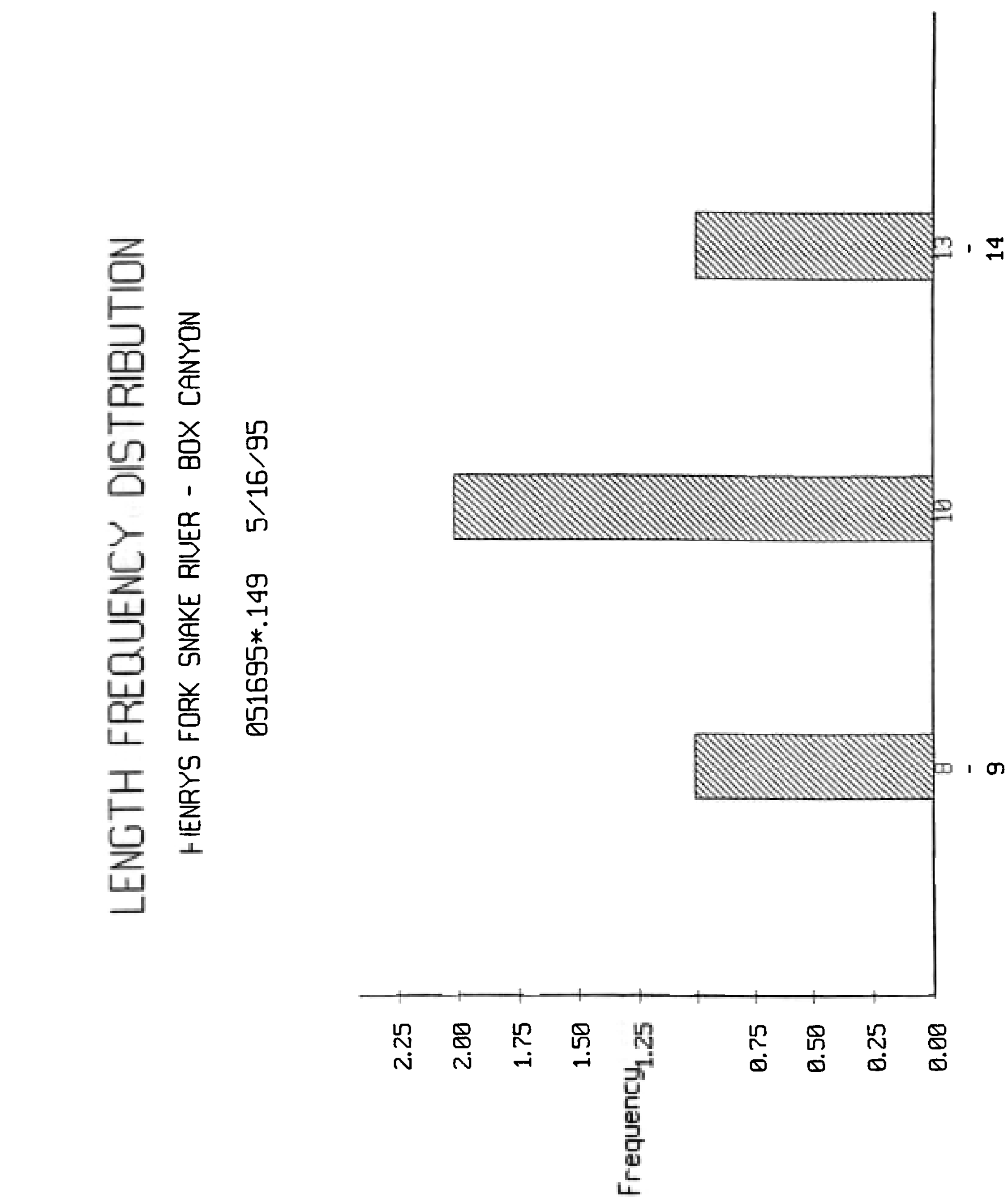
Appendix B. Continued.



Appendix B. Continued



Appendix B.


LENGTH FREQUENCY DISTRIBUTION
HENRYS FORK SNAKE RIVER - BOX CANYON
051695*.149 5/16/95
Frequency
2.25
2.00
1.75
1.50
1.25
0.75
0.50
0.25
0.00
8 - 9
10
13 - 14

1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-20

Project II: Technical Guidance

Subproject II-G: Upper Snake Region

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

Technical guidance was provided to federal, state, county, municipal and private agencies/entities upon request. Technical guidance was also provided to organized sportsmen's groups, conservation organizations and private citizens in the form of fish pond development, stocking and management advice, funding requests and project feasibility opinions, and various conservation and educational programs.

Upper Snake Region and Fishery Research staff also organized and conducted a "Trout Management Workshop" for members of the Henrys Lake Foundation and other citizens interested in the Henrys Lake fish management program. This workshop modeled the Henrys Lake trout population and fishery, allowing the attendees to better understand the current fish management program and predicted benefits to the fishery with changes in the current fishing regulations package.

Regional fishery management personnel contributed over 120 person-days to technical guidance requests in 1994.

Author:

Mark Gamblin
Regional Fishery Manager

1995 ANNUAL PERFORMANCE REPORT

State of: Idaho

Program: Fisheries Management F-71-R-20

Project III: Habitat Management

Subproject III-G: Upper Snake Region

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

Riparian fencing was completed on Howard Creek and Targhee Creek below Highway 87. Shoreline fencing was completed between Howard and Targhee creeks, and off-site watering was installed adjacent to Howard Creek. All projects were conducted on the Diamond D Ranch located on the eastern shore of Henrys Lake. Riparian vegetation supplementation was conducted on Howard Creek on the existing exclosure fencing in cooperation with The Nature Conservancy and volunteers.

Authors:

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Regional Fishery Biologist

Mark Gamblin
Regional Fishery Manager

INTRODUCTION AND STUDY AREA

Since the early 1980s, the Upper Snake Region fishery management program has worked with local ranchers and the Henrys Lake Foundation to improve Henrys Lake tributary spawning and rearing habitat, provide fish passage around in-stream barriers, and reduce cutthroat trout *Salvelinus fontinalis* fry losses to irrigation diversions. These projects include riparian fence to control livestock grazing damage, reestablishment of riparian vegetation communities, and irrigation diversion fish screens. Each project is designed to maintain or increase the significant gains that have been achieved, in the last 15 years, towards restoring and enhancing cutthroat trout spawning and recruit production for the Henrys Lake fishery. In 1995 we added new fence and riparian vegetation plantings to important habitat on Howard and Targhee creeks.

The Department has also cooperatively installed, operated, and maintained two irrigation diversion fish screens on important South Fork Snake River cutthroat trout spawning tributaries, Burns Creek and Palisades Creek, working with local landowners and the Bureau of Reclamation. The Burns Creek screen has run continuously for over 20 years with little or no maintenance. In 1995, with assistance from Regional Habitat Management and Salmon Fish Screen Shop personnel, the Burns Creek fish screen was pulled and overhauled. We also made repairs to the bypass pipe system to correct water leaks and inefficient transport of cutthroat trout fry migrating to the Burns Creek channel.

OBJECTIVES

1. Restore and enhance cutthroat trout spawning and rearing habitat in critical Henrys Lake tributaries.

2. Restore and enhance cutthroat trout fry migration success and survival back to Henrys Lake.

3. Operate and maintain fish screens on Burns and Palisades creeks to restore and enhance cutthroat trout fry migration success back to the South Fork Snake River.

METHODS

Henrys Lake Riparian Projects

Riparian exclusion fencing was completed on approximately 1 mile of Howard Creek in June and on 1/3 mile of Targhee Creek in May. Approximately 3/4 mile of fence was also completed 300 meters above the lakeshore between Targhee and Howard creeks to protect sensitive wetlands and to reduce shoreline erosion from cattle overgrazing. Riparian fence was 3-strand, high tensile electric fence. Shoreline fencing was 2-strand, high tensile wire.

An off-stream watering system was installed adjacent to Howard Creek to minimize water diverted from Howard Creek into irrigation laterals. This involved running 2-inch PVC pipe underground from the existing diversion structure on Howard Creek approximately 3/4 mile to the center of a grazing complex. Pasture rotation and an intensive grazing system was made possible by construction of a corral around two tanks equipped with ball float valves supplied by the buried pipe. The corral was enclosed with electric high tension wire fence, and 2-strand, high tensile wire electric cross fencing was connected from the corral/cell-center to the Howard Creek riparian fence to the south and to the lake shore fence to the west (approximately 3/4 mile in each direction).

Burns Creek Fish Screen

The Burns Creek fish screen was pulled and transported to the Salmon River Fish Screen shop in the winter of 1994-1995 by Regional Habitat Management staff. Fish Screen Shop personnel rebuilt the fish screen, which was transported back to Burns Creek and reinstalled prior to the spring 1995 cutthroat trout spawning, run. Sections of the bypass pipe system were replaced with new pipe, and some of the pipeline was repositioned to improve its performance.

Palisades Creek Fish Screen

The Palisades Creek fish screen was operated and maintained throughout the 1995 irrigation season (June 1 to November 1) by a temporary fish screen tender.

RESULTS AND DISCUSSION

Henrys Lake Riparian Projects

Riparian fencing was completed on Howard and Targhee creeks below Highway 87. Shoreline fencing was completed between Howard and Targhee creeks and off-site watering was installed adjacent to Howard Creek. All projects were conducted on the Diamond D Ranch located on the eastern shore of Henrys Lake. Riparian vegetation supplementation was completed on Howard Creek on the existing exclosure fencing on the Howard Creek Ranch in cooperation with The Nature Conservancy and volunteers. Revegetation included 1,000 rooted aspen plugs, 120 rooted bog birch plugs, 150 bare willow slips, and 80 potted rose plants.

Off-site watering has greatly reduced the need for flood irrigation in pastures adjacent to Howard Creek on the Diamond D Ranch. During the period of peak irrigation it has been estimated that 80% more water is retained in-stream. Coupled with high-intensity, low-duration grazing made possible by cross fencing and pasture partitioning with portable fencing, there will be much less pressure placed on riparian vegetation. Also, nitrogen loading from cattle excrement will decrease due to the increased buffer zone provided.

Burns Creek Fish Screen

The fish screen and by-pass pipe were operational throughout the 1995 cutthroat trout spawning and fry migration season. We later received reports of additional problems with the bypass pipe after the fry migration season. This problem will be corrected before the 1996 cutthroat spawning season begins.

Palisades Creek Fish Screen

The fish screen and by-pass pipe were operational throughout the 1995 cutthroat trout spawning and fry migration season. No significant problems were encountered. This is the second year of operation.

RECOMMENDATIONS

1. Work with the Henrys Lake Foundation to develop funding and labor sources for the long-term operation and maintenance of existing Henrys Lake tributary riparian fences and fish screens.

2. Commit to no future riparian fence or irrigation diversion fish screens until new sources of operation and maintenance funding and labor are developed. Annual operation and maintenance monetary and labor costs have exceeded the available resources of the regional fish management and Henrys Lake program budgets.

3. Continue to work cooperatively with The Nature Conservancy on fish habitat and fish population enhancements in the Henrys Lake Outlet on the Flat Ranch.

4. Reexamine the Burns Creek fish screen by-pass pipe system and redesign or repair as necessary to ensure long-term security and dependability for cutthroat trout fry migration survival to the South Fork Snake River. Continue to operate and maintain Burns and Palisades creeks fish screens.

1995 ANNUAL PERFORMANCE REPORT

State of: Idaho | Program: Fisheries Management F-71-R-20

Project IV: Population Management | Subproject IV-G: Upper Snake Region

Contract Period: July 1, 1995 to June 30, 1996

ABSTRACT

At Palisades Reservoir, approximately 500 to 1,000 game fish, including cutthroat trout *Oncorhynchus clarki*, rainbow trout *O. mykiss*, brown trout *Salmo trutta*, lake trout *Salvelinus namaycush*, and mountain whitefish *Prosopium williamsoni* were salvaged from the three dewatered stilling basins and released in the river below. As in 1994, lake trout of a variety of small sizes were seen, further confirming natural reproduction of the species in the reservoir.

Upper Snake and Southwest Regional personnel captured 297 smallmouth bass *Micropterus dolomieu* by electrofishing at Brownlee Reservoir (Woodhead Park). These fish were all fin-clipped and released into Ririe Reservoir to supplement the population.

We stocked 13 mountain lakes with a total of 23,500 fingerling Arctic grayling *Thymallus arcticus* and Henrys Lake cutthroat trout. All fish were reared at and stocked from Mackay Fish Hatchery. We used the Challis National Forest fire standby helicopter (Bell Jet Ranger) to stock all lakes. The Bell Jet Ranger was under-powered for the job and should not be considered for that task again. Procedural difficulties with the federal government make private contracting of helicopters a more reliable method for this task in the future.

Authors:

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Senior Fishery Research Biologist

INTRODUCTION AND STUDY AREA

Annual maintenance operations at the Bureau of Reclamation Palisades Dam facility requires that the spill gates be closed, the stilling basin immediately below the gates be drained, and repairs be made to the concrete surface of the stilling basin. This operation routinely traps and strands hundreds of trout and whitefish. The Bureau of Reclamation staff at Palisades Dam coordinates with the Upper Snake Region to ensure salvage of those fish.

The Ririe Reservoir smallmouth bass *Micropterus dolomieu* population was established in 1986. Since then smallmouth bass numbers and size have fluctuated. Both mean size and relative numbers reached all-time lows in 1992 and continue to the present. At the request of local bass anglers, the Upper Snake Region captured 297 smallmouth bass from Brownlee Reservoir. Captured fish were marked with a fin clip and released in Ririe Reservoir to evaluate the benefits of supplementing the naturalized Ririe Reservoir smallmouth bass population and to provide an index of their relative abundance.

Regional mountain lakes that are managed for angling opportunity are stocked on a three-year rotation (updated in 1994) with a variety of species of trout *Oncorhynchus spp.* and Arctic grayling *Thymallus arcticus* fry.

METHODS

Palisades Reservoir Dam Spillway Salvage

On October 17, 1995, regional personnel salvaged fish stranded in the stilling basin in the Palisades Dam spillway during routine cleaning and maintenance by the Bureau of Reclamation. The salvage operation was conducted with the help of Bureau of Reclamation employees.

Stranded trout and mountain whitefish *Prosopium williamsoni* were captured with backpack electroshockers after being crowded with a 150-foot beach seine into the far ends of each of the three cells of the stilling basin. Captured fish were transported by hand in buckets to the main river immediately below the stilling basin and released. We did not collect data from captured salmonids, although rainbow trout *O. mykiss* and rainbow-cutthroat trout *O. clarki* hybrids were killed and donated to charity.

Ririe Reservoir

Smallmouth bass were captured with electrofishing equipment in Brownlee Reservoir on May 18, 1995 and immediately transported to Ririe Reservoir by hatchery truck. Before transportation, each fish received a ventral fin clip for future identification in the Ririe Reservoir fishery. The contribution of these fin-clipped bass to the Ririe Reservoir fishery was monitored during bass tournaments that same summer.

Mountain Lake Stocking

All fish were reared and stocked from Mackay and Ashton fish hatcheries. We used the Challis National Forest fire standby helicopter (Bell Jet Ranger) to stock most lakes on September 15, 1995 at no cost to the Department. Big Fall Creek and Mill Creek lakes were stocked on foot by Idaho Department of Fish and Game (IDFG) personnel August 22, 1995. GPS coordinates were recorded for all mountain lakes in the Upper Snake Region west of the Lemhi Range.

RESULTS AND DISCUSSION

Palisades Reservoir Dam Spillway Salvage

Over 500 trout and whitefish were successfully salvaged from the stilling basin and released back to the main river. Less than 50 rainbow trout or rainbow x cutthroat trout hybrids were killed to avoid reintroducing them into the South Fork Snake River cutthroat trout population. At least 30 lake trout *Salvelinus namaycush* were also captured. Lake trout occasionally migrate out of Palisades Reservoir into the South Fork Snake River. We noted that many of the 1995 salvaged lake trout were young fish that undoubtedly were naturally spawned in Palisades Reservoir. We noted the same occurrence in our 1994 salvage operation. This provides us with strong evidence that lake trout are successfully reproducing in Palisades Reservoir. Lake trout supplementation from Jackson National Fish Hatchery was ceased in 1991.

Ririe Reservoir

A total of 297 smallmouth bass were successfully released to Ririe Reservoir (Figure 1). Monitoring results of their contribution to the Ririe Reservoir smallmouth bass fishery will be covered in a future report.

Mountain Lake Stocking

We stocked one mountain lake in the Fall River Highlands, 13 lakes in the Pioneer Mountains, one lake in the Boulder Mountains, and one lake in the Lemhi Range (Table 1). In the 16 lakes 28,300 total fry were planted.

The Bell Jet Ranger helicopter was far under-powered for the task. It should not be used again for mountain lake stocking in this program. Conflicts with availability of standby helicopters during the fire season, and unplanned for delays created significant problems for us that made meeting our schedule for lake stocking difficult. In the future, we will not rely on Forest Service helicopters.

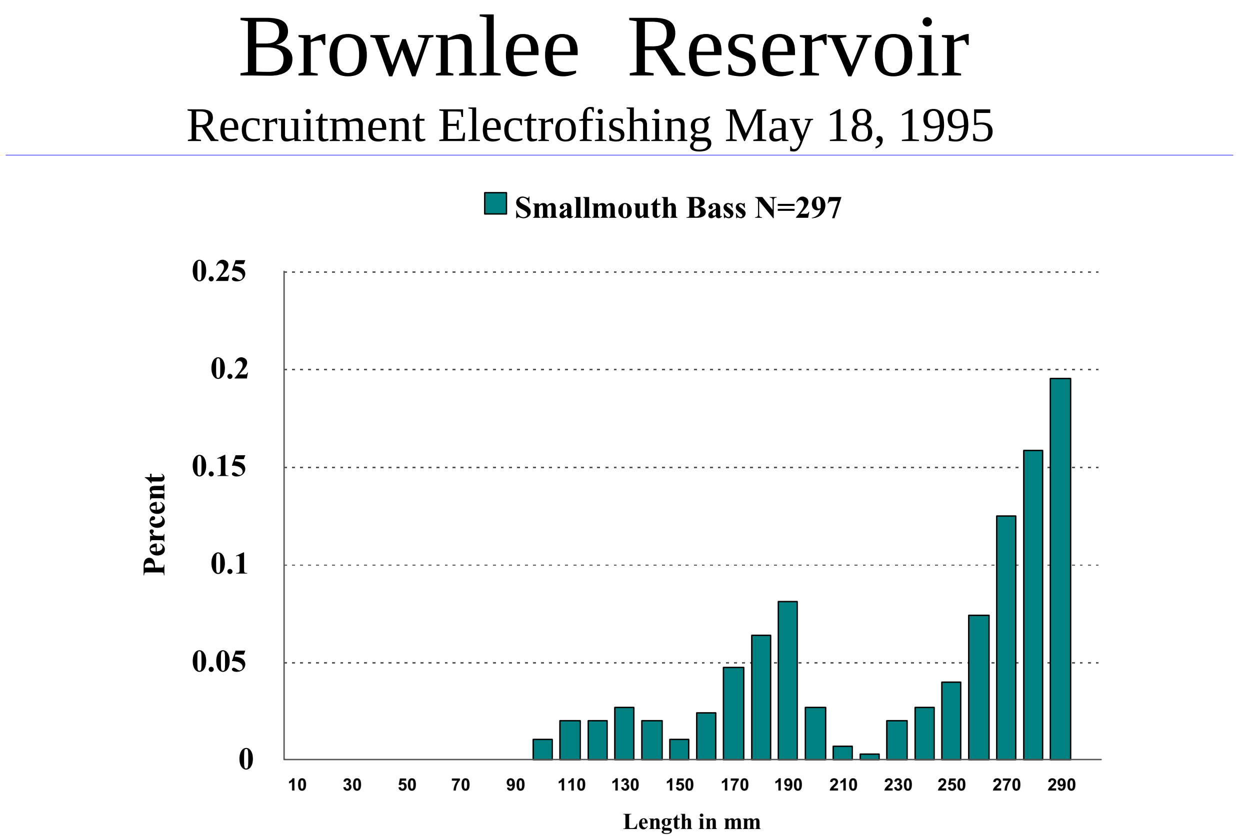

Figure 1. Length frequency distribution of smallmouth bass captured by electrofishing in Brownlee Reservoir and transplanted to Ririe Reservoir May 18, 1995. All fish were ventral fin clipped for evaluation.

Table 1. Mountain lakes in the Upper Snake Region stocked with fry, 1995.

Lake name	IDFG catalog #	# stocked	Species[a]
Fall River Highlands			
Horseshoe[b]	12-0114	2,800	GR
Pioneer Mountains			
Big	15-0183	3,500	CT
Rough	15-0186	2,500	CT
Long[b]	15-0187	3,000	CT
Round	15-0191	1,500	GR
Golden[b]	15-0184	1,000	GR
Lake Creek #11[b]	15-0188	500	CT
Lake Creek #13	15-0189	500	GR
Green[c]	15-0203	1,000	CT
Brockie	15-0128	1,500	CT
Iron Bog #1[b]	15-0129	3,500	CT
Fish Pole[b]	15-0130	3,500	CT
NF Bellas[d]	15-0176	500	GR
Baptie[b,d]	15-0200	1,000	GR
Boulder Mountains			
Big Fall Creek[b,d]	15-0209	1,000	GR
Lemhi Range			
Mill Creek[b,d]	15-0124	1,000	GR
Total:	Cutthroat	19,000	
	Grayling	9,300	
	Grand Total:	28,300	

[a] GR = Arctic grayling, CT = Henrys Lake cutthroat trout.
[b] Species and/or number stocked are different from schedule three-year rotation (modified in 1994).
[c] No scheduled Arctic grayling stocked.
[d] Out of scheduled three-year rotation (modified in 1994).

RECOMMENDATIONS

1. Continue Palisades Reservoir dam spillway salvage as needed.

2. Discontinue supplementation of Ririe Reservoir with smallmouth bass.

3. Do not use Bell Jet Ranger, equivalent or less in horsepower, for regional mountain lake fish stocking efforts. Utilize privately contracted helicopters or volunteers in the future for stocking mountain lakes.

ACKNOWLEDGMENTS

Bureau of Reclamation personnel from the Palisades Dam operations office and guides from the South Fork Lodge furnished valuable assistance to the salvage operation at the Palisades Reservoir stilling basin. Brian Flatter, Dale Allen, Frank Bottoms, and the staff of the Nampa Fish Hatchery helped with capture and transportation of smallmouth bass from Brownlee Reservoir to Ririe Reservoir. Bart Gammett and Mike Foster, Lost River Ranger District, Challis National Forest, and Bill Doerr and Mick Hoover of the Mackay Hatchery were instrumental in our mountain lake stocking efforts.

Submitted by:

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